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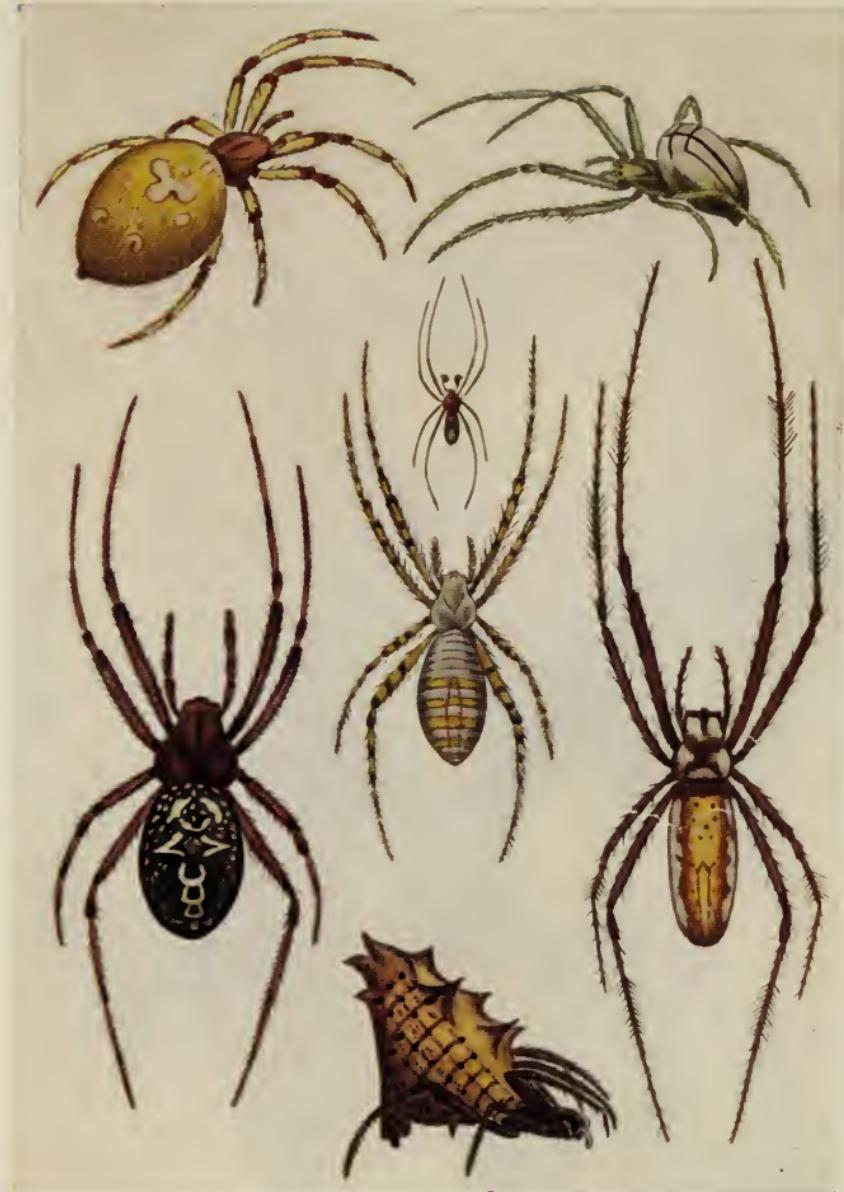


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SPIDERS CURIOUS AND BEAUTIFUL

Shamrock Spider ($\times 1\frac{1}{2}$).
Epeira Vertebrata ($\times 1\frac{1}{2}$).

Banded Argiope, male (Nat. size).
Do. female (do.).
Acrosoma gracile ($\times 3$).

Orchard Spider ($\times 2$).
Plumefoot Spider
(Nat. size).

SPIDERLAND

BY
R. A. ELLIS

WITH PHOTOGRAPHS AND DRAWINGS
BY THE AUTHOR

CASSELL AND COMPANY, LTD
London, New York, Toronto and Melbourne
1912

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**AFFECTIONATELY
INSCRIBED TO MY FATHER,
ROBERT POWLEY ELLIS, M.V.O.**



PREFACE

THE scarcity of books on the subject of spider life is my excuse for assuming the rôle of guide into "Spiderland." The fruit of personal observation and reading is set forth, in as graphic a form as I could command, by pen and camera. By the special permission of Dr. H. C. McCook, of Philadelphia, U.S.A., several figures have been adapted for the purposes of this book from "American Spiders and their Spinning-Work." Dr. McCook, whose death occurred in September, 1911, spent many years in the study of spiders and their ways. Writing to me from Brook Camp, Devon, Pa., U.S.A., eight months before his death, he stated that he was much interested in my project of getting ready a popular book on spider life. In the course of his letter, he said : "I have sometimes thought that I would edit a popular edition of my three volume folio work, but I have not been let hitherto. And now I have reached an age and condition of health that debars such work. . . . I give the heartiest consent to your using as much of the book as may suit your pleasure and your purpose." Through Dr. McCook's

PREFACE

kindness, many interesting phases of the spider life of the American continent have been introduced.

This book is intended primarily for young folk: wherever possible, therefore, technical terms have been avoided.

I hope that it may prove to many young readers an introduction to a little-known realm of Nature study, and inspire in them a desire to explore for themselves the wonderland of Nature.

R. A. E.

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INTRODUCTION

THE spiders of our houses and gardens are members of a very large family inhabiting Spiderland. They fall naturally into two classes, the Weavers and the Wanderers. They vary greatly in size, form, colour, and modes of life. The habits of these tiny folk, in snare-forming and nest-building, are most interesting ; and their spinning-work is marvellously adapted to the conditions under which they may happen to be placed. They are an astute and philosophic race. As the sage observed, they are “little upon the earth, but they are exceeding wise.” Come with me on a visit to some of the typical members of this world-wide family, and see how they fare in their homes, how those homes are built, with what ingenuity traps are laid for their prey, and with what great care the cradles are formed for the comfort and protection of the baby spiders.

The spider has sometimes been spoken of as the “horrid” spider, and some are by no means handsome. That is hardly a crime that justifies execution. We have said, doubtless with perfect sincerity,

“Weaving spiders come not here;
Hence, you long-legg’d spinners, hence.”

We shall find, however, that the spider is one of those whose friendship improves on acquaintance. As we pursue our study, we shall discover that many of them are far from ugly or unlovely ; that many are, in form and colour, both curious and beautiful ; and that their snares are true works of art. While Nature withholds her secrets from the indifferent, she is an open book to every willing learner.

“Come forth into the light of things,
Let Nature be your teacher.”

SPIDERLAND

CHAPTER I

STRUCTURE OF THE SPIDER

IN order to understand how the spider spins, hunts, feeds, sees, feels, and otherwise fulfils its place in the economy of life about us, we must know something of its structure. We do not wish this to be a dull, uninteresting porch leading to Spiderland. We will, therefore, illuminate it by pictures taken from Nature, so that we may faithfully represent what even the most careful drawings would fail to do.

If we look attentively at a spider in the garden or hedgerow, as it gently sways in the centre of its snare, or hangs suspended from a leaf by its thread, we shall see that it can be distinguished without difficulty from an insect. The body of an insect has three clearly defined parts. This is not so with the spider. Here we find but two distinct parts—the “cephalo-thorax,” formed by the head and thorax being dovetailed together; and the “abdomen,” the rounded softer portion of the creature’s body.

We shall not be slow to mark other differences, as we compare an insect, such as the all too familiar fly, with its deadly foe the spider. Whereas the insect has six legs, the spider will be found to be

the happy possessor of eight, unless, of course, an accident has occurred to rob it of any; even then, it will not be greatly troubled, for the next time it casts its skin, which it does about nine times during its lifetime, Dame Nature will present it with a new limb with the new skin. We shall not, therefore, be prepared to find cork legs in requisition in Spiderland.

The legs are seven-jointed, and are furnished with strong, comb-like claws. These claws are very often used as cleansing instruments, for the spider is very cleanly in its habits, and keeps a clean person and home. The claws, of which we speak, are also required in the capture of prey. Their principal use, however, is in the construction of snares and cocoons.

In the process of spinning, the foot plays a most important part. The spider always directs her threads by the wonderfully sensitive, comb-like instrument with which the foot terminates. By its means she draws in her lines and makes them taut. The claw of the orb weaver is a combination of three horny combs with teeth. One of the combs is considerably smaller than the others, and has three teeth, while the larger ones have fifteen or sixteen. In addition to the claws, there are two or three small auxiliary combs, or toothed spines, which the spider is able to move towards the claws. They thus fulfil the part that the thumb plays on the human hand, and enable the spider to grasp her threads firmly. By means of her claws, the spider is able to suspend herself on "her most attenuated thread." They aid her also in ascent,



FOOT OF ORB-WEAVER, SHOWING THREE
CLAWS AND AUXILIARY COMB



CLAWS FROM THE FOOT OF
A DIADEM SPIDER

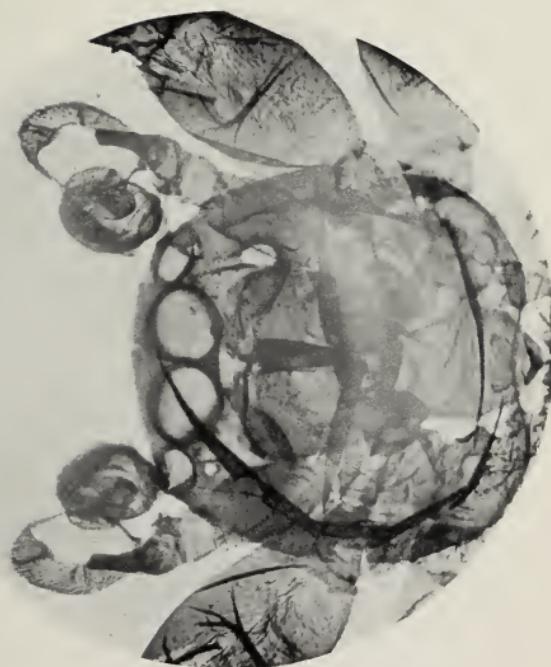


ORB-WEAVER'S CLAWS, ALSO AUXILIARY COMBS

HEAD OF WOLF SPIDER, SHOWING HOW THE EYES ARE PLACED IN A WATCH TOWER



HEAD OF MALE LEAPING SPIDER, SHOWING POSITION OF EYES AND CLUB-LIKE PALPS



her rope being hauled in, hand over hand, and rolled up under her in the form of a loose ball of silk. "The spider taketh hold with her hands, and is in king's palaces."

The antennæ or feelers of an insect, such as a butterfly or moth, are rather prominent features. With spiders there are no real feelers, but there are five-jointed organs called palps, like shortened legs, attached to the mouth parts. These palps protrude in front of the spider, and, together with the forelegs, serve the purpose of feelers.

Upon the palp of the female may be seen a toothed claw, which looks not unlike the hook upon a wooden arm. It serves the spider well in her dealings with prey, as we shall see if we watch her after she has made a capture. She turns and twists the morsel this way and that, by these hand-like organs, in the process of disposing of her victim. These handy instruments of hers are found to be most useful also in grasping and carrying her cocoon. Some mother spiders carry the cocoon about with them for several weeks, clutched tightly to their bodies by these useful little hands.

The palps with which the male is adorned are strange-looking, club-like organs, of very complicated structure. This possession readily distinguishes the spider "lord of creation" from his mistress.

The eyes of the spider are simple in formation, like the three simple eyes on a bee's head, and much resemble the eyes of animals. There is nothing to correspond to the large, bay-window kind of eyes that insects mostly possess. The number of eyes varies according to the species. Some have only

two, others six, but the majority are blessed with eight gem-like eyes, protected with a transparent, horny covering. The eyes are frequently lacking among spiders that live in caverns, where perpetual darkness reigns. A spider's eyes are usually placed upon a slight eminence, forming a kind of watch-tower. The creature is thus enabled to observe the approach of friend or foe, and, at the same time, to detect the presence of prey in the immediate neighbourhood. This more especially applies to the hunting spiders.

Spiders are armed with powerful weapons, which serve them well in times of peace or war. The spider's toothed and poisonous fangs are brought into requisition in the regular supply of its dinner-table ; and, being its own butcher, it can make sure of its meat being always fresh. These implements of death are hard and hollow, and have a small hole near their points through which the poison is emitted. They are further used by the spider in the defence of its home and person from foes of its own kind ; for spiders are great fighters and terrible cannibals.

The mouth is situated immediately behind the jaws, and is an organ for suction only. Around it are the lips, by means of which the spider crushes out the juices of insects that are unfortunate enough to come between them.

The apparatus by which the spider has earned its name and reputation as a spinner, is situated near the extremity of the abdomen. It consists of spinning fingers, with many tiny spools, or spinning tubes, at the ends, out of which the silk issues.



HAND-LIKE PALP OF ORB-WEAVER



JAWS OF SPIDER



JAWS, MOUTH, AND PALPS OF FEMALE
DIADEM SPIDER



SPINNERETS OF ORB-WEAVER



SPINNERET SHOWING SPOOLS ABOVE

Among the orb-weavers we find six of these spinning fingers, as can be seen by reference to the accompanying photograph, where those of the Diadem Spider are represented. One of the fingers has been photographed alone, to show more clearly the little points, or spools, which occupy the rounded end. The spools are thickened at the base and narrowed at the ends, looking like pencils with the lead thrust well out and sharply pointed. There are in all about six hundred and eighty of these spools upon the six spinnerets. The spinnerets are provided with muscles by which they can be moved freely at the will of the spider in the process of the spinning operations. They can be brought closely together, as the finger and thumb are brought together, for forming the threads of the snares.

The spider has the power to control the various parts of her spinning machinery, and regulate the flow of silk according to need. There are times, for instance, when fine silken gossamer only is required ; at other times the viscid beads are needed for the manufacture of the snare ; then, again, when an insect becomes entangled a thick sheet is woven around the victim ; and, again, when the cocooning season arrives, golden threads are exuded, as a blanket for the protection of the eggs. The spider exercises her skill by using certain tubes for particular purposes, while certain other tubes are held strictly in reserve for other uses, by the exercise of the muscles, with which the parts are provided.

It will be well, after having looked at the external features of the spider, to give a glance at its internal

structure. If we could see through the skin of a spider, as through a glass window, we should have revealed to us quite a complex anatomy. I have endeavoured to accomplish this task by photographing a section of a spider. The softer parts are not clearly defined, but a general idea of the relation of the various parts may be obtained.

According to our very natural expectation, we find that the spinning machinery takes up a large portion of the abdomen. The word "spider" means "spinning one," and is allied to the word "spinster," the mistress of the spinning-wheel of an age that is past. In the Greek story, Arachne was transformed by Minerva into a spider, because of her proud boast that she possessed superior spinning powers. This name is used to designate the class to which the spider belongs in the animal world.

We have seen with what lavish kindness Nature has bestowed spinning spools upon the spider. We find that for each little spool or tube there is a corresponding spinning gland, manufacturing the liquid silk, and sending it down through the channel provided. There are three different kinds of glands, supplying silk for the various uses to which the spider applies her spinning work. So long as the little creature is kept well nourished, so long will the glands respond to her demands and fulfil their delicate office. As the silk is required it is squeezed out by muscular power, just as air can be squeezed out of a rubber ball with a hole in it. These silk glands, or reservoirs, are more highly developed in the orb-weavers than in other species. The Diadem Spider has nearly seven hundred, while the House



COMB ON FOURTH LEG OF SPIDER
USED FOR TEASING OUT FINE
THREADS



FOOT OF WOLF SPIDER



SECTION OF SPIDER

Spider has only about half that number. Nature has a way of awarding a kind of consolation prize to the hunters of Spiderland for their lack in spinning power, by giving them great keenness of sight and swiftness of limb.

By means of her spinning organs the spider is able to weave snares for her prey, cradles for her offspring, airships of finest gossamer, silk-lined retreats in earth and water, shrouds for her victims, and, not seldom, a monument to her lord. With marvellous wisdom and power of adaptation the spider brings into use the various glands and spinnerets she possesses, in order to meet these manifold needs.

The brain of the spider merges into a central nervous system running throughout the body, and branching off in different directions in tiny nerve fibres. Like a system of electric wires radiating from a central electrical station, this network of fibres keeps the more distant parts in direct and constant touch with the centre of activity.

If a spider is examined, there will be noticed under its body, near the juncture of the legs, two little rounded portions, rather lighter in colour than the general colour of the body. These indicate the position of the lung-books or gills, by means of which the spider breathes. These gills consist of delicate white leaflets, triangular in shape. Each lung is furnished with about fifty of them. By reference to the photograph facing p. 8, it will be seen how they are arranged one beside the other in the form of a book: hence the name of "lung-books." These leaflets are for enlarging the surface of the membrane over which

the blood flows, in the process of purification by the air.

The blood of the spider is a clear fluid, which is sent from the central pumping station to the various parts of the body by branching blood-vessels, and is brought into contact with the lungs by means of arteries.

In the forepart of the cephalo-thorax, generally called the head, are located strong muscles for working the jaws. Here are also the poison glands which supply such deadly power to the fangs in the capture of prey. The spider is mercifully able, by this provision, to render unconscious all insects that fall victims to her voracious appetite. These insects are not eaten in a solid form, but the juices of their bodies are drawn up by muscular power into the sucking stomach, situated in the centre of the thorax. It will be seen by reference to the photograph of the section of a leaping spider facing p. 92 that this part of the body is furnished with powerful muscles. The food is conveyed from the sucking stomach into a somewhat extensive digestive canal, for further treatment and final absorption into the body.

This brief, general survey of the structure of the spider will doubtless suffice as an introduction to the habits and achievements of the skilful inhabitants of Spiderland.



FORE PART OF BODY OF WOLF SPIDER



A SPIDER'S LUNG-BOOK

CHAPTER II

MOTHER-LOVE

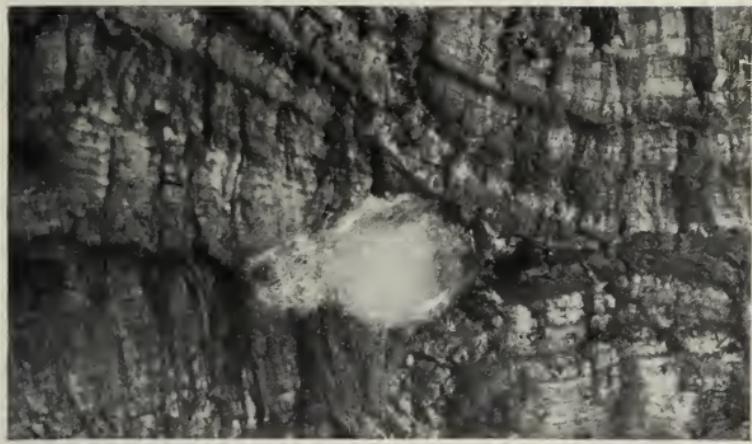
IN spite of their bloodthirsty nature there is abundant evidence of much mother-love among spiders in their cocoon-building habits. The spider's nest is always the work of the mother; and if "wife" means "weaver," she fulfils her part, as such, with exemplary faithfulness. The cocoon is made for the protection of the eggs from marauding birds and weather changes, and is often an object of great beauty and interest. The following examples of nest-building are taken from the various walks of life in Spiderland, and will illustrate the care and concern of Mother Spider for her young brood in the egg state.

We have often come across a flossy mass of silk of golden hue, similar to that woven by silkworms, tucked away in the crevices, or behind the loose bark, of an old tree trunk. Opening out the mass of silk, we shall find, packed firmly together, a large quantity of tiny eggs, numbering perhaps seven or eight hundred. These are the eggs of the familiar Diadem Spider of our gardens.

I once took a mother Diadem Spider from my garden, and placed her in a glass jar. The next day I found she had made a flossy silken pad, upon

which she was in the act of depositing her eggs—a semi-transparent, glossy mass of rich golden hue. She then proceeded to blanket them up for the winter. She opened her spinnerets to the full, and, with her hind legs, spread out her beautiful yellow silk evenly over the eggs. I was much interested and entertained by observing this process. Lowering her spinnerets upon the egg-pad, she beat down the silk with her hind legs. Then she raised her abdomen, lifted her hind legs, and again beat down the silk. Thus she continued, her body and hind legs working alternately and repeatedly, spreading out and beating down the silk with wonderful regularity. After two hours' diligent work a large ball of silk was spun around the eggs. Then cables were run out like guy-ropes, this way and that, securely fastening the cocoon to its anchorage. Three weeks after, having accomplished this exhausting work in the interests of the future generation, the little mother died.

Some orb-weavers utilise a leaf for the protection of their flossy cocoons. These cocoons very much resemble those fastened upon leaves by certain moths in the caterpillar state, preparatory to their change into the chrysalis form. The cocoon in this case is a hammock, spun by the caterpillar around itself by means of its mouth parts, and slung securely among the leaves of the food plant. It thus forms a kind of ante-room, in which the insect awaits the call to perfect life. With the spider, however, the cocoon is an asylum, to shield the young spiderlings from prowling enemies and winter storms. It is, moreover, a nursery, within



THE GARDEN SPIDER'S COCOON
MAY OFTEN BE FOUND TUCKED
AWAY IN THE CREVICE OF AN
OLD TREE



MOTHER GARDEN SPIDER HANGING
UPON THE GUY ROPES OF HER
COCOON FIXED ON THE SIDES OF
A GLASS JAR



A LEAFY CANOPY FOR THE
PROTECTION OF THE EGGS

the walls of which they gain strength for the strenuous life awaiting them.

There is a large orb-weaver of North America, known as the Basket Argiope, which suspends among low bushes and tall grasses a little parchment-like flask about an inch wide, within a network of yellow threads. This is her egg-basket or cocoon, wherein she has carefully bestowed her thousand eggs. With the utmost care and industry, she has woven for them a bed of soft flossy silk, and with great skill has tucked them in for the winter. Strands of strong silk, nicely placed, secure the cocoon in position against the disturbing effects of wind and rain.

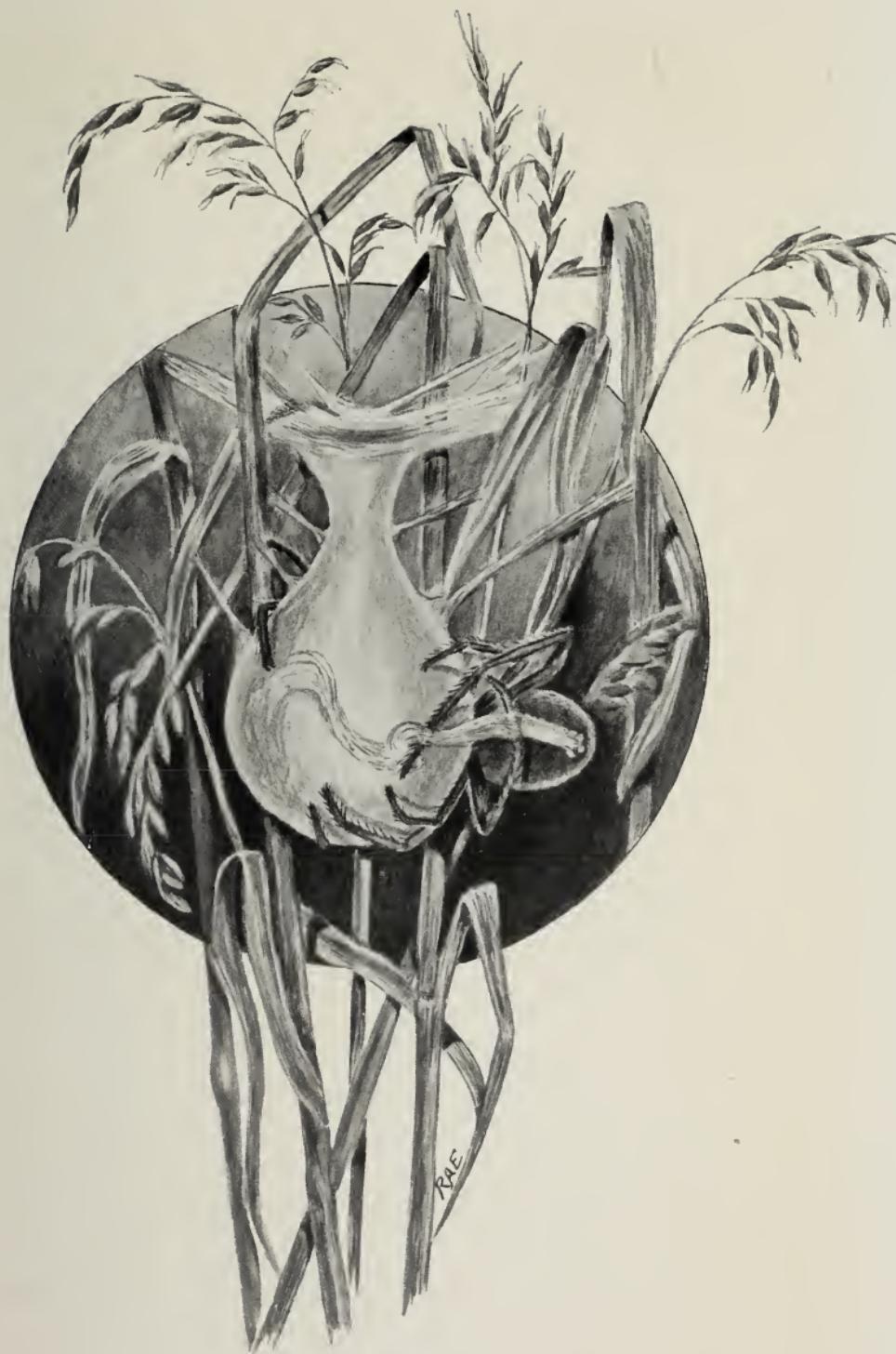
In the making of this delicate casket the mother spider has drawn out from her spinnerets innumerable threads of fine silk, which she has spread out by the alternate use of her hind legs. The threads are looped and curled and finally interwoven into the mass of spinning work. This is a long and toilsome process extending over two or three hours. Great care is taken in order to ensure the silk being spread evenly over the entire surface. As wool is wound into a ball from the skein, so the little spinster carries her silken threads over each portion of her cocoon in turn. The result of these efforts is a treasure house of wonderfully symmetrical and beautiful form. The final touches having been given the outer covering wears the semblance of soft felt, well fitted to shelter the hope of the future within from all the storms that may rage without.

There is another large orb-weaver, domiciled on the other side of the Atlantic, known as the Banded

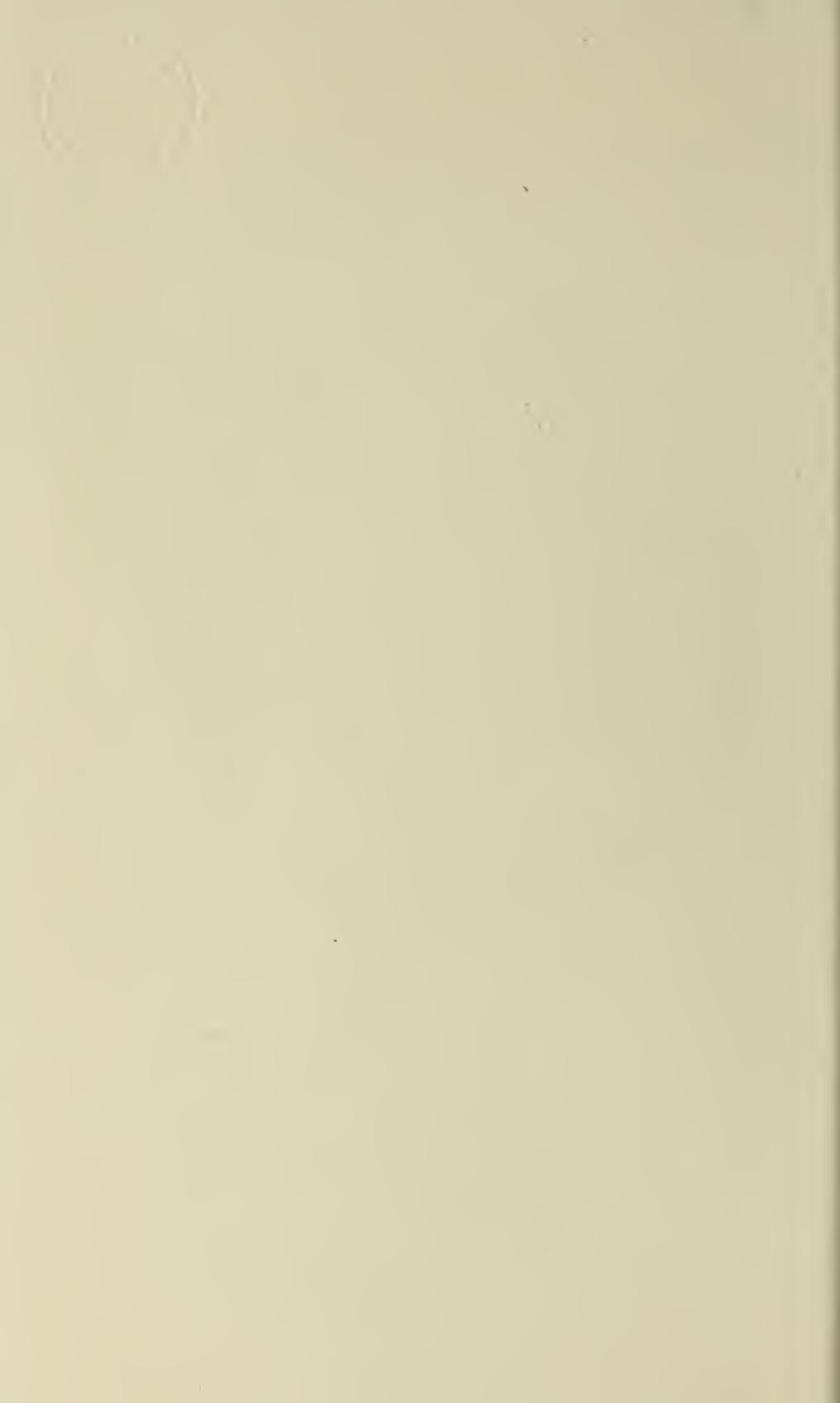
Argiope. She expresses her mother-love by the careful construction of a delicate silken cocoon in the form of a cup, to which she entrusts her eggs. This cradle is fitted with a strong lid and hung among wild plants and grasses. The leaves of the plants and the heads of the grasses are drawn around by a network of golden threads, to form a protecting canopy. When the wind blows the cradle may rock, but secure and undisturbed abides the treasure within.

The cradle bears a striking resemblance to a kettledrum, the tightly-drawn cover of stiff yellow silk affording an admirable protection for the eggs within. Sometimes two of these drums are seen fastened one above the other, as if the spider, having closed up one cocoon, had decided, as by an after-thought, to improve upon her first endeavours. An example of such work will be seen in the accompanying illustration, which has been drawn from nature. The second cocoon came no whit behind the first in point of size and finish. They were both composed of light grey silk, streaked with dark green and adorned with golden threads. Fastened down by the side of the cocoons was the wing of a dragon-fly, evidently the scraps of a feast.

If one of these pretty little egg-sacs were opened, there would be found a most ingenious arrangement for the protection of the eggs. The hard outer covering encloses a mass of delicate, flossy silk, enshrouding an egg-pad of loosely woven silk plush. The whole is shielded above by a thick cover stretched flat upon the top of the cocoon and fastened with guy-ropes to the stems of wild plants.



BASKET ARGIOPE COCOON BUILDING





CANOPIED CRADLES OF BANDED ARGIOPE

The delicate workmanship and careful placing of the nest reveal, in a marked degree, both motherly affection and forethought, which, in a creature so small, cannot fail to excite our wonder and admiration.

The ways of the little tailed spider which has received the name of Caudata, afford a fine example of maternal affection. From the upper section of her orb-web she removes the spirals, and within this free space she forms a string of bead-like nests about the size of peas. In these cradles, which range from three to eight in number, the eggs are snugly blanketed.

When first constructed, the nests assume the form of plain, yellowish, silken sacs, of a sufficiently close texture to make them waterproof. Eventually the mother decorates her cradles with the trophies of her warfare, as an American Indian might adorn his wigwam with the scalps of his victims. These trophies are nothing more than the mortal remains of flies and beetles, the litter of her larder, which the spider uses, not so much to beautify as to protect her treasure. Young spiders attach the debris of insects to pellets of silk. This is their way of playing at being mother.

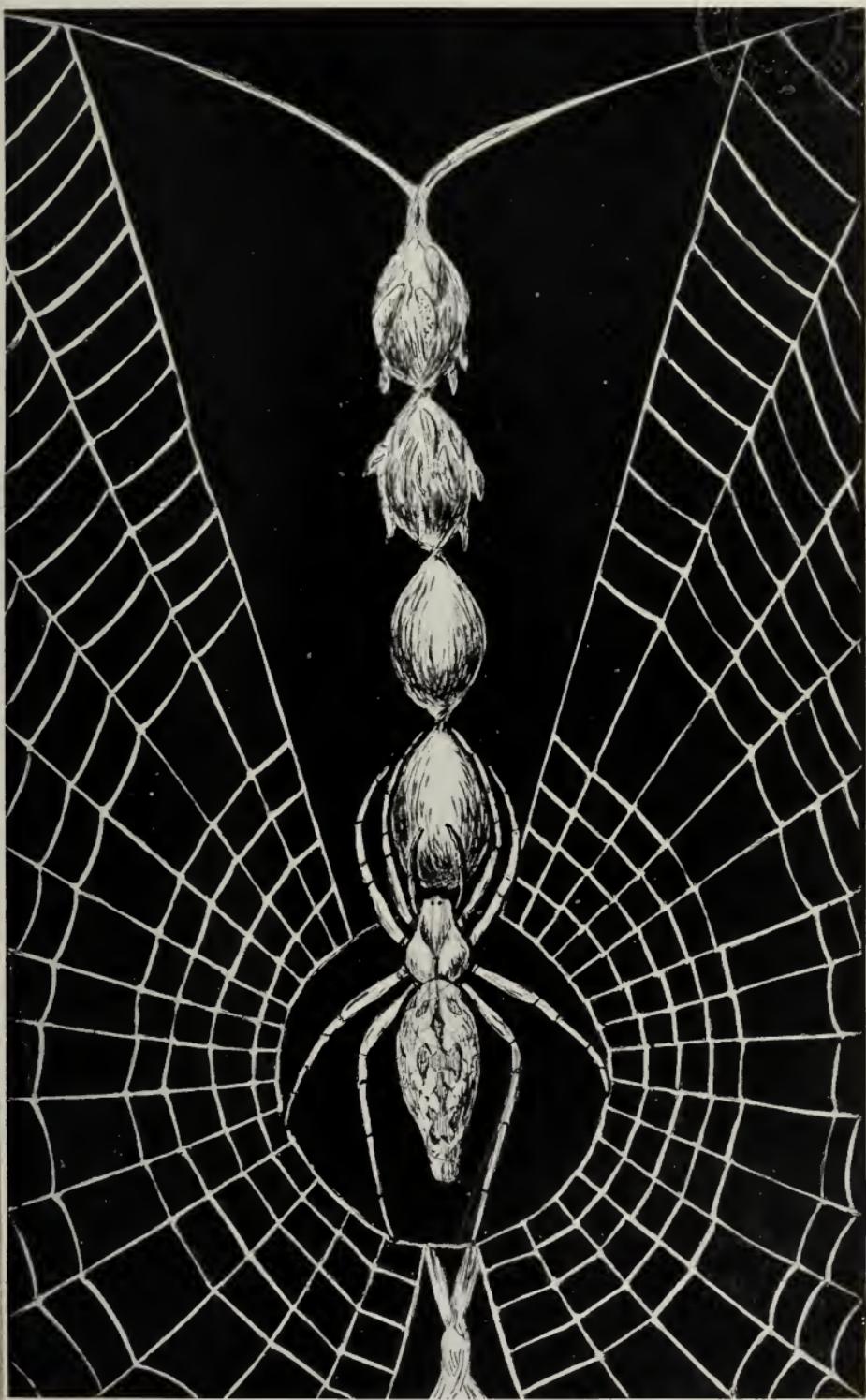
In the illustration facing p. 14 the parent spider may be seen clinging to the last formed of her cocoons, ready to repel the attack of any egg-devouring foe, or die in the attempt. Here we have another example of the power of mother-love, so widely prevalent in Spiderland.

About our gardens and greenhouses we find the small round cocoons of a little line-weaver similarly

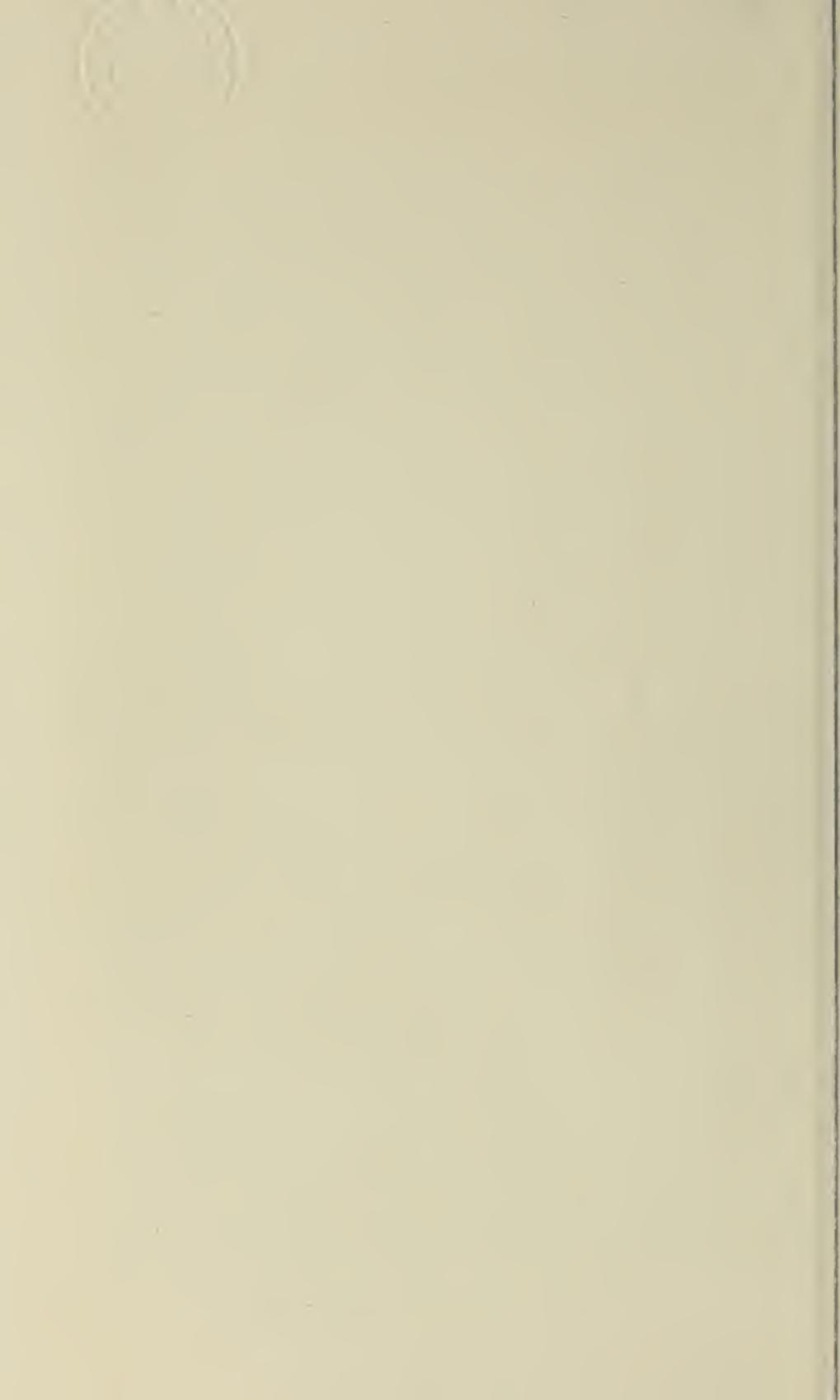
decorated. They are of perfectly white flossy silk, and gradually assume a ragged, dirty appearance, as the debris of insects becomes attached piecemeal to their sides. Three or four of these cocoons will be seen in the inner recesses of a single snare, the last one added to the tale being perfectly white, the rest more or less obscured by the particles of rubbish accumulated around them. Is this a blind habit of the race, a merely natural instinct, or can we here trace thought for the preservation of the young ? The constraining force is surely a yearning mother-love ; for spiders, though great haters, are good lovers, if so be that " love's strength standeth in love's sacrifice."

We again turn to the line-weavers for another example of the motherly instinct, so delightful to contemplate, in this tiny creature world. There is an interesting little tent-maker, *Riparium* by name, which has developed quite a taste for decorative art. She constructs a silken wigwam, one and a half to two inches in length and half an inch in diameter. This she embellishes with pellets of earth, withered leaves, twigs, flowers and bits of straw, in such a way as effectively to hide from the observation of her natural enemies the yellow silken cocoons containing her eggs. These cocoons are ingeniously slung in the apex of her tent, the lower portion being reserved as a dining-room for the mother and a play-room for her young.

The character of the material used for the walls of the home depends on the particular surroundings in which the spider finds herself. When the nest is near the ground, earth is used ; when on old walls,

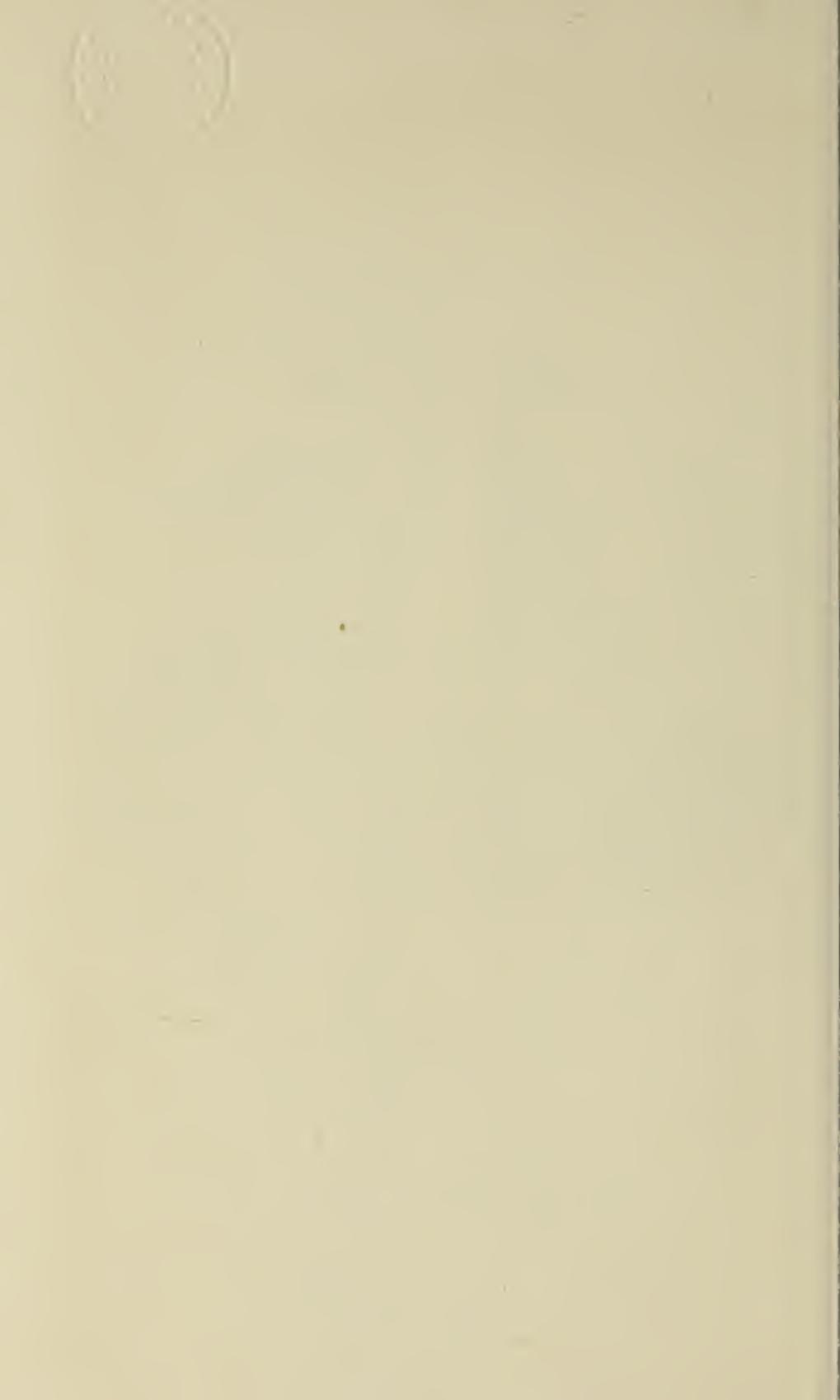


DECORATIVE NESTS OF TAILED SPIDER (*CAUDATA*)





RIPARIUM'S ADORNED WIGWAM



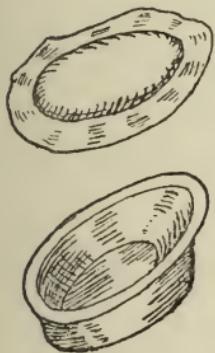
mortar is used ; when among bushes, leaves and flower petals are used.

The mother remains in the immediate vicinity of her home, preying upon ants and keeping strict guard over her defenceless charges until the young spiderlings hatch out. They remain about the old home for several weeks after emerging from the cocoon, enjoying the affectionate attention of their devoted parent. She is unfailing in her attentions, and provides the youngsters with food until they are able to fend for themselves.

Among the crossed lines of the upper portion of the Labyrinth Spider's snare may be found a string of curiously shaped cocoons. These are oval vessels of tough yellow silk, and resemble little pie-dishes filled with eggs and covered in with a pie-crust — dainty dishes indeed. The cocoons are composed of two portions, joined at the edges, for all the world like a vegetable dish and cover. These parts fall away under the strain of

the developing life within, and the young hopefuls proceed to make a way for themselves in the world.

Each Labyrinth Spider makes four or five of these little pie-dish cocoons, which are lashed together



Labyrinth Spider's cocoons

in a string, overlapping one another like tiles on a roof. The whole precious cargo is anchored to the interlaced lines in the upper part of the snare by white silken cables, and the vigilant little mother takes both night and day duty in her care for her offspring.

There are true plasterers to be found in Spider-land, which encase their cocoons with an envelope of mortar of tolerable thickness. The little balls of silk are provided with a cord, for attachment to stones or the under surface of wood. The mud is apparently smeared in layers over the cocoon, for it peels off in thin flakes like the outer covering of an onion.

We can imagine the industrious little mother busying herself over her labour of love, fetching tiny pellets of clay with her mouth parts from the ground, and pounding them evenly into the surrounding mass till, after very many journeys and much arduous toil for so small a builder, she rests satisfied with her work. The frail cocoon containing the eggs is formed of pure white silk, a few strands of which are carried through the mud covering to form a foot-stalk for support.

One can hardly see how such clay-encased cocoons could possibly be infested by parasites. It is true, nevertheless, that they are often found to contain the empty pupal cases of flies. In one case, it was observed that these parasites had taken their fill of the ample feast of spiders' eggs and made their exit through their mud prison by boring a hole such as we often find made in dried galls.

Another plasterer is Brunnea, a little sheet



NESTS OF BRUNNEA, SHOWING APPEARANCE BEFORE
AND AFTER BEING PLASTERED WITH MUD



weaver, which has earned the name of the "Fairy-lamp Maker," because of the very shapely and artistic nests she makes. About the month of June the mother forms a cocoon of white silk, which is attached by a foot-stalk to the grass stems or heather. When first spun, the cocoon looks like a tiny wine-glass, turned upside-down. The idea that more strongly suggests itself on seeing it is, perhaps, that of a miniature fairy-lamp hung out for the fairies' midnight revels.

The nest measures about one-fourth of an inch in diameter, and contains something like fifty yellow eggs. These are carefully fastened with white silk to the roof, within this delicate little abode. In the Natural History Museum at South Kensington may be seen some excellent examples of these nests in their various stages of development. The pristine whiteness of the cocoon soon gives place to the much less attractive appearance of a splash of mud on the gorse or heather bushes. But this is doubtless the whole intention of the "Fairy-lamp Maker." Her purpose evidently is to disguise the presence of her nest and protect its precious contents, as far as she is able, from her enemies and the elements. After all her care the eggs are often found infested by ichneumon flies in the grub state.

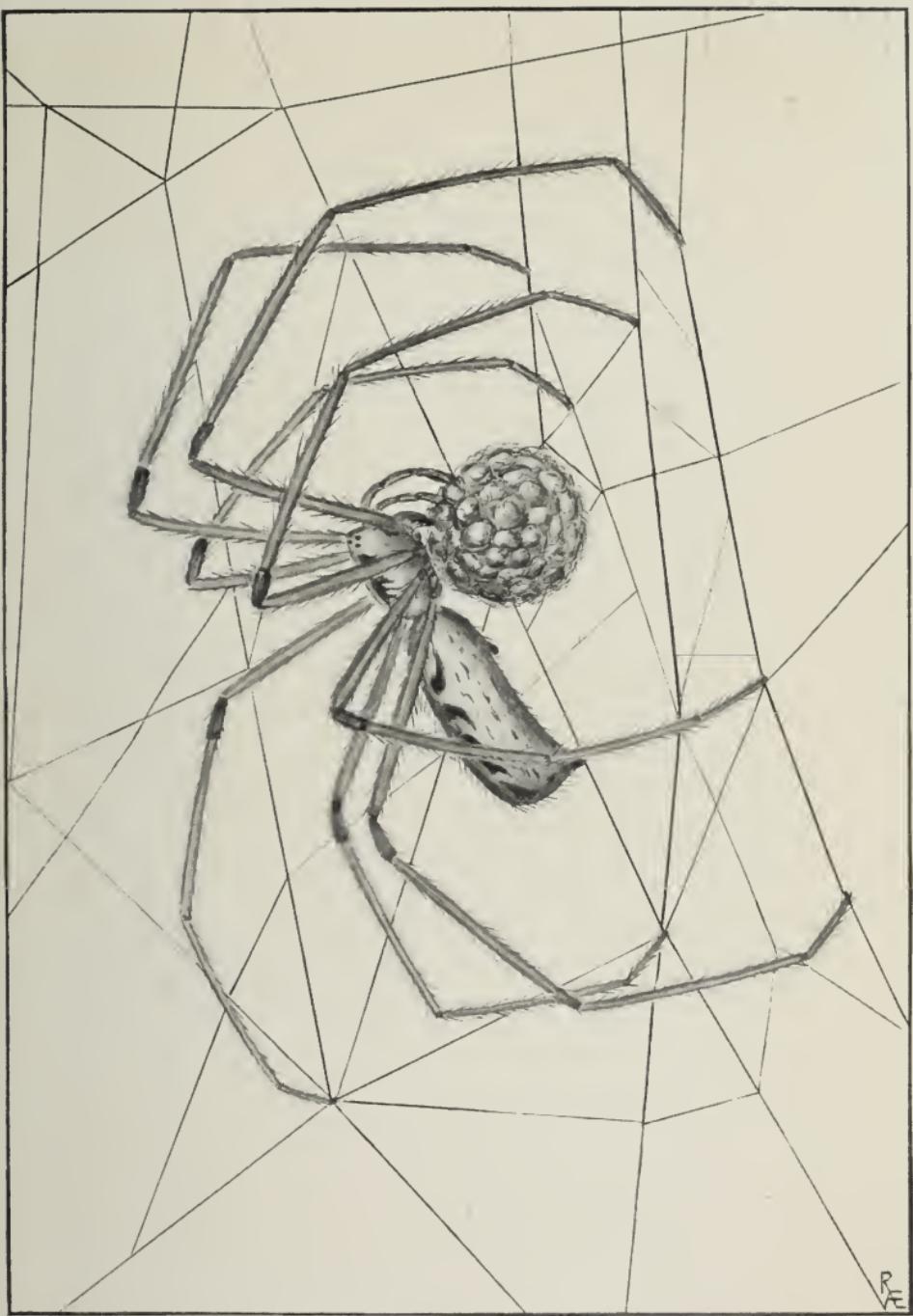
The task of plastering over the cocoon with mud and welding it to its support is no light one. The ingenious worker, in order to accomplish this, conveys the moistened earthen pellets by means of her mouth parts and fore legs from the ground to her nest on grass stem or heather. She carefully presses the mud into position with her feet and hand-like

palps, and overspreads it with her spinning work. Owing to the fact that it is bound together in its construction by many silken threads the hardened mud covering does not dissolve by rain. One unacquainted with the habits of this spider would never think that the little heart-shaped pendants of brown mud were the "Fairy-lamp Maker's" nests.

Great indeed must be the mother-love of the spider to induce her to undertake this arduous task in the interests of her young brood. One asks : Why this labour and sacrifice for the generation yet to be ? Will that generation appreciate the sacrifice ? That the faithful worker will never know. Her duty is clear. That is all she knows and needs to know.

The experiment has been tried of using spiders' silk for the manufacture of gloves and stockings. Some of these articles were actually made in France in the year 1709, and subsequently other attempts have been made. The material utilised for this purpose was cocoon silk, which was found to be much stronger than the silk used in snares, although very much inferior to the silk of the silkworm. One difficulty that presented itself was the large number of spiders required, for it takes seven thousand to weave a pound of silk. However, the prospect of such an industry, from a commercial point of view, came to an end with the untimely end of the spiders kept in captivity, for it was found to be impossible to restrain these loving mothers from eating each other up.

There is a curious-looking, long-legged creature, having the air of one walking on stilts, which rejoices



A FOND MOTHER (*PHOLCUS PHALANGIOIDES*) GUARDING HER
EGG CASKET

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in the long-legged name of *Pholcus phalangioides*. She is much like the familiar "Harvestman" to look at, as one of her names implies, but she differs in the fact that she is a true spider, while the "Harvestman" is not. He lacks spinning apparatus, and has no division between his head portion and the abdomen such as is seen in spiders.

This lanky spider is one of those anxious creatures which are so much attached to their offspring that they dare not trust any such device as we have been considering for their protection. They must needs carry their nests about with them. The habit of our leggy friend, *Pholcus*, is to hang among her lines, fondly clinging to her globular mass of eggs with her mouth parts. The eggs are most lightly enveloped in fine silk, and are to be distinctly seen through their finely spun wrapper, which is one of the simplest forms of cocoon we find in Spiderland.

So far as we can tell, the spider receives no instruction in cocoon-making. It seems all a matter of intuition, and cannot fail to excite our wonder when we think of the skill and care with which the work is invariably carried out from start to finish. We find in a cocoon some parts loosely woven, to form a soft bed for the eggs; and other parts closely compacted and pressed firmly down for protection from stress of weather and prowling egg devourers. The finished structure is a ball of wonderfully well-rounded and elegant appearance, and the surprise to us is that a creature with such natural limitations can accomplish such marvellous work.

CHAPTER III

YOUNG AVIATORS

A SPIDER does not start life by the prolonged process through which an insect is called upon to pass. That is to say, it has no intermediate grub and chrysalis state between the egg and the perfect form. It leaves the egg a spider, and, during the process of growing up, must fend for itself as best it can. The butterfly only emerges a perfect insect from the chrysalis after having passed through the dreary pilgrimage of grubdom.

On the other hand, that most nearly allied creature, the scorpion, the first cousin of the spider, dispenses with eggs and the weary business of cocoon-making altogether. The young are precipitated straight into the world as venomous young scorpions. I once placed a mother scorpion I had captured in a glass jar, and the next day I saw two little flaps under the mother's body open and a swarm of about thirty young scorpions make their exit. They then proceeded to climb upon her tail and back, jostling and crowding one another for foothold. They were somewhat more egg-shaped than the mother, and their tails were shorter, in proportion to their size, than hers; but they were ready enough to curl their tails when annoyed, and

A MOTHER SCORPION





doubtless had a modicum of venom in their scimitar-like weapons with which thus early to defend themselves.

Spiderlings upon emerging from the egg state are helpless little creatures, unable to spin or even to feed. They are generally very pale and colourless, like the mites we see in ripe cheese. They are encased in skin which covers their mouth parts and spinnerets. They therefore remain patiently in the cocoon and await the first moult. This takes place during the first few days of life. The skin cracks around the sides of the body, allowing the prisoner to escape. The legs, having been withdrawn from their sheaths, are used to hasten the process of moulting. The baby spider kicks off the old casing with its hind legs as it struggles into larger life. Many spiderlings eat their own way through the walls of the cocoon. Others are aided by the efforts of their guardian mother, who tears holes in the nest for their escape. The spiderling is then in a position to become initiated into the secrets of the spinning art.

The process of moulting continues for several months, till, after nine or ten successive changes of raiment of steadily increased capacity, the spider may be said to have grown up. When we have seen what appeared to be the mortal remains of spiders sticking to webs in outhouses and along garden walls, we have doubtless concluded that the poor creatures had met with sudden death. The spider may with little difficulty be found in the vicinity, enjoying life after the manner of its kind. The remains we see are but cast-off coats that once

belonged to the occupant of the den, but in sublime forgetfulness it has now left them hanging, tattered and torn, on the back door.

It is interesting to observe the way in which the small members of the spider's household take their first outing. Gradually emerging from the innermost recesses of the cocoon, they start weaving their way up and down a branch or upon a fence. When kept in captivity, one notices that they have a great love for the light, and naturally wend their way to the window on self-laid tracks. Quite a network of fine filaments is thus speedily woven, upon which they keep holiday.

One day I found upon a privet hedge a leafy cradle of young orb-weavers, with their fond mother hanging in the webbing above. Without disturbing the household, I took the branch and placed it under careful observation in my study. The little creatures shyly retreated within the cocoon whenever the slightest disturbance announced the approach of danger. They first ventured to come as far as the outer surface or roof of their abode ; then, gaining in boldness after a fortnight's comparative inactivity, they coursed up and down upon the branch, passing from leaf to leaf till all became netted together with their frail spinning work. When the window and door were opened, and a draught was thus created, the youngsters were to be seen taking flight after the manner of spiderlings under the influence of fine weather and a gentle breeze. They emitted long, fine filaments, by which they were carried off their feet into the air. They thus allowed themselves to be wafted out of captivity to ampler regions.



FIRST VENTURES FROM THE NEST

The mother remained the faithful guardian of her charges for a few weeks. Then, when the brood ballooned away, she died, probably feeling that there was nothing left in this world to live for. In order to launch her family into life she had given up her own life. This is only one of many instances in Nature of the sacrifice of self for the well-being of the community and the preservation of the race.

We are bound to acknowledge, when we speak of modes of travel, that the spider moves with the times. She is ingenious beyond her years. She has solved the problem of the flying machine without falling a victim to it. Her habit of life is to balloon. It is the recognised method of emigration in Spider-land. No surprise, therefore, need be entertained should a neighbour drop in on one, all unawares, out of the blue.

The flying spider constructs her airship in the following manner : Facing the wind, in some elevated position on hedge, wall, or reed by the water-side, she raises herself by extending her legs to their full length, so as to form a circle with them. She then pays out some silken threads, light, airy filaments, which are borne aloft upon the wind. The silk is paid out until it is able to overcome, by its buoyancy, the weight of the little aeronaut's body. The spiderling then springs from her vantage-ground and away she voyages on the breeze. Firmly she grasps the threads of finest silk as she takes her aerial journey. Of these threads she weaves a magic carpet, which conveys her to some delectable region more or less distant from the old home.

When this primitive airship does what some balloons of human skill have been known to do, and entangles itself in some bush or tree, the aviator at once tumbles to it and begins forthwith to set up housekeeping on the spot. By this happy arrangement of separating numerous members of a family, every spiderling has the opportunity of earning a livelihood, and the good of each becomes the best for all.

It is most pleasing to witness the ballooning of spiders, and to see them float about as if the law of gravitation had no influence upon them. They drift upwards on the breeze, or float gently over the grass, with the least possible concern. They even appear to be able to control their frail airships by hauling in the supporting threads. They are thus not entirely at the mercy of air currents, but at times alight at will.

These tiny balloonists may be seen by the hundred on gate-posts and fences in summer, and from the vantage-ground thus afforded they will take their aerial flight. Their activity is at first revealed by the presence of a thick matting of fine threads upon the gate-posts or wall. A number of streamers will presently be borne aloft by the breeze. Upon these threads the young adventurers set forth merrily upon their voyage of discovery. It excites our wonder to see these frail, wingless creatures overcoming their natural limitations, in such a manner as to be able to compass great distances, by ballooning on the breeze.

That the distances traversed by baby spiders are considerable is proved by authentic reports of the

BALLOONING SPIDERS

SENDING OUT A TRIAL CABLE



aerial journeys of spiders being arrested by ships at sea. Darwin records how, at a distance of sixty miles from land, large numbers of tiny spiders became entangled in the rigging of the *Beagle*. The fine filaments, on which they were seen to be voyaging, were caught by the ship as it crossed their course. Some of the spiderlings continued their trackless journey upon the breeze after a momentary arrest. The captain of a ship sailing two hundred miles east of the American coast reports that innumerable spiders suddenly covered his vessel. They were borne on a west wind, each being buoyed up by an umbrella-like canopy of fine webbing.

As baby spiders balloon about in their first ventures from the old home, descending on grass and hedges, and running hither and thither, over leaf and blade in holiday vein, their long silken fibres are formed by the breeze into flying threads. These threads, which we call "gossamer," have an annoying way of catching our faces as we take our evening stroll. Their extreme fineness renders them almost invisible, except when touched by the sun's rays. They are especially noticeable on the grass, in early autumn mornings, after heavy dew.

The eye often catches the sheen of these delicate filaments as they lie on the hedges, or mass themselves on grass-heads and wild plants. Careful observation often reveals the presence of young spiders trailing their threads over all they touch, or sending them forth upon the breeze.

A certain degree of mystery was at one time woven about these innumerable floating threads,

when there was no sign of life to account for them. Spenser, in "The Faerie Queene," speaks of

"The fine nets, which oft we woven see,
Of scorched dew."

There is little likelihood, at this time of day, of misnaming the spinning work of spiderlings "scorched dew."

A gossamer shower may occur wherever a large number of young spiders, on a specially favourable day, are of one mind, and one heart, in making their first efforts at aerial navigation. The threads of countless multitudes of youthful spinners wave to and fro in the breeze, becoming massed together and entangled, and then released from their anchor-age by the force of the wind.

Gilbert White, in his "Natural History of Selborne," tells us that the stubble and clover grounds were so matted over on one occasion with a thick coat of cobweb, that "when the dogs attempted to hunt, their eyes were so blinded and hoodwinked that they could not proceed, but were obliged to lie down and scrape the incumbrances from their faces with their fore feet." Later in the day, when the sun was up and all was calm and serene, "a shower of cobwebs" claimed his attention, "falling from very elevated regions, and continuing, without any interruption, till the close of the day."

These gossamer threads seen sailing in cloudland were evidently drawn up by ascending currents of air, after being dried by the sun. A change in atmospheric conditions would account for their coming back to earth again in this airy, fairy



PICTURESQUE HEDGEROWS OF HAWTHORN, BRAMBLE, AND
WILD ROSE FORM GOOD CAMPING GROUND FOR SPIDERS

shower of softest silk. As they descended, they were to be seen "twinkling like stars" in the rays of the sun.

On warm summer evenings the young orb-weavers may be seen clinging to one another in a mass. Upon any disturbance of the peace the little yellow and black fellows scatter like a puff of smoke. They descend by their threads like a sudden shower of golden rain. Harmony is, however, soon restored, and we see the little spinners stealing back along their fine lines when all danger is past. They close in upon one another, like bees in a swarm, tucking away their little legs till the living mass assumes its globular form again.

This state of family life, apparently so harmonious, is often marred by cannibalism. A large family of orb-weavers is often sadly reduced in numbers by such means. By a happy provision of Nature many spiderlings appear to gain the sustenance they require from the moisture of the atmosphere or drops of dew. They delight to sip the morning dew. Their method of drinking may be observed by placing a drop of water upon their tiny threads. They will seize it with eagerness, grasping the liquid with their mouth parts and forelegs, until the globule is absorbed. Spiderlings enjoy a drink, and may be kept for months with an occasional drop of water, from a camel's hair brush, for sustenance. Their baser propensities may, possibly, lie dormant, to develop later when they banquet on the ruddy drops that warm the hearts of their insect prey.

The young spiders, having acquired the art of

spinning, soon crave for independent life. Without mother, nurse, or instructor, save Dame Nature, they weave their own destiny with great perseverance. The result of first efforts on the part of these young apprentices to the spinning art is, what it often is with us, crude, though promising. But the spider has a name for perseverance, and, doubtless, the lesson is early inculcated : "If at first you don't succeed, try, try, try again." Long ere maturity is reached, at the ninth moult, the spinning art is learnt to perfection.

In the meantime, many and various are the excursions into spider architecture that are undertaken by the youthful aspirant. Only a few cross-lines mark the first stage of orb-weaving. Then there appear representations, in miniature, of the full-orbed snare in the efforts that are made. Within the meshes of these frail webs are ensnared many of the tiny insects with which the summer air is burdened. With steady persistence the young spider fashions a still more worthy web on the ruins of her past endeavours ; till, finally, she sits proud and expectant, within a snare full-orbed and worthy of her great ancestry.



A QUIET RIVER BANK IS AN IDEAL CAMPING GROUND
FOR SPIDERS

CHAPTER IV

ORB-WEAVING

ENGINEERING skill has attained, in the spider world, a standard of no mean order. The skilful little bridge-builder, with some degree of judgment, selects a site for her operations. This site is generally in such a position as the most effectively to secure for her the game she needs for sustenance. Many spiders' webs are sure to be seen by the banks of quiet streams. Here spiders find excellent conditions for setting their snares, and a happy hunting ground for insect prey. Gnats and flies frequent the water-side in great abundance. The water itself has an attraction for other members of the spider family of a roving and piratical disposition, who constitute themselves into a special constabulary for keeping the course clear, to the no small terror of the insect tribe. The stone walls that form the boundaries between fields, and the more picturesque hedgerows of hawthorn, bramble, and wild rose, also form equally good camping grounds for spiders innumerable, curious, and beautiful, where they may be studied with profit and delight.

The spider's method of bridge-building is very similar to that adopted by the engineer who threw across Niagara the first bridge to span that mighty

gorge. We are told that a string was first of all cast from bank to bank, across the raging torrent, by means of paper kites. Next, thin wire was drawn across. Then heavier wires were passed over in succession, till, at length, the foundation cables were laid, and the famous bridge rose into being.

In much the same manner is the spider's skill displayed. Seated on a post or reed, by river or roadway, she exudes her liquid silk from her manifold spinnerets, as from the rose of a watering can. The spider varies her methods by suspending herself in a swinging basket or hammock, from which she sends out her trial lines.

Immediately after leaving the spinnerets, the silk hardens by contact with the air and forms a single strand, fine and strong. The loose end of this ribbon is carried on the breeze till it forms an attachment to some friendly branch or stem. A small sheet of adhesive silk, woven at the loose end, aids this operation. The spider, to form this tiny parachute, brings her spinnerets together, then separates them, thus breaking up the viscid matter into fine threads.

The parachute, borne by air currents, drags with it the line which is destined to form the foundation of the web. When the trial cable finds anchorage, the little engineer hauls in the slack portion with her fore feet in order to make the line taut. After making all fast with her spinnerets, she proceeds to strengthen what now becomes the foundation of her bridge. She passes and repasses over it with her thread, and runs out supporting lines in various directions, that her work may withstand wind, dew,



THE GARDEN SPIDER IN SUSPENSION

and rain, or the onrush of insects. The framework serves for many occasions, the remains of the old web being thrust aside to make room for the newly woven snare. I have known orb-weavers utilise old foundation lines again and again, for a period of six weeks, in sheltered spots.

The method of orb-weaving, so far detailed, will explain how it is that we often see orb webs extending over ponds or streams, between water plants. These suspension bridges are sometimes of great length, measuring from twenty to thirty feet, over streams or roadways.

Instead of flying a trial thread, the weaver very often lays down her framework "by hand"; that is, she creeps over the bushes, dragging her lines with her, and, from point to point, casting anchorage by means of her spinnerets for the foundation of her snare. These also are often very extensive. An orb-weaver which appropriated my greenhouse for her camping ground, made a foundation line, where there was no breeze to aid her, extending ten feet across from end to end. I tested the strength of this cable by hooking pins upon it, and found that it was only when half an ounce of them were swinging upon it that the breaking point was reached.

The busy little worker having made her foundation cable secure, proceeds, with astonishing rapidity and ingenuity, to lay her snare for the unwary.

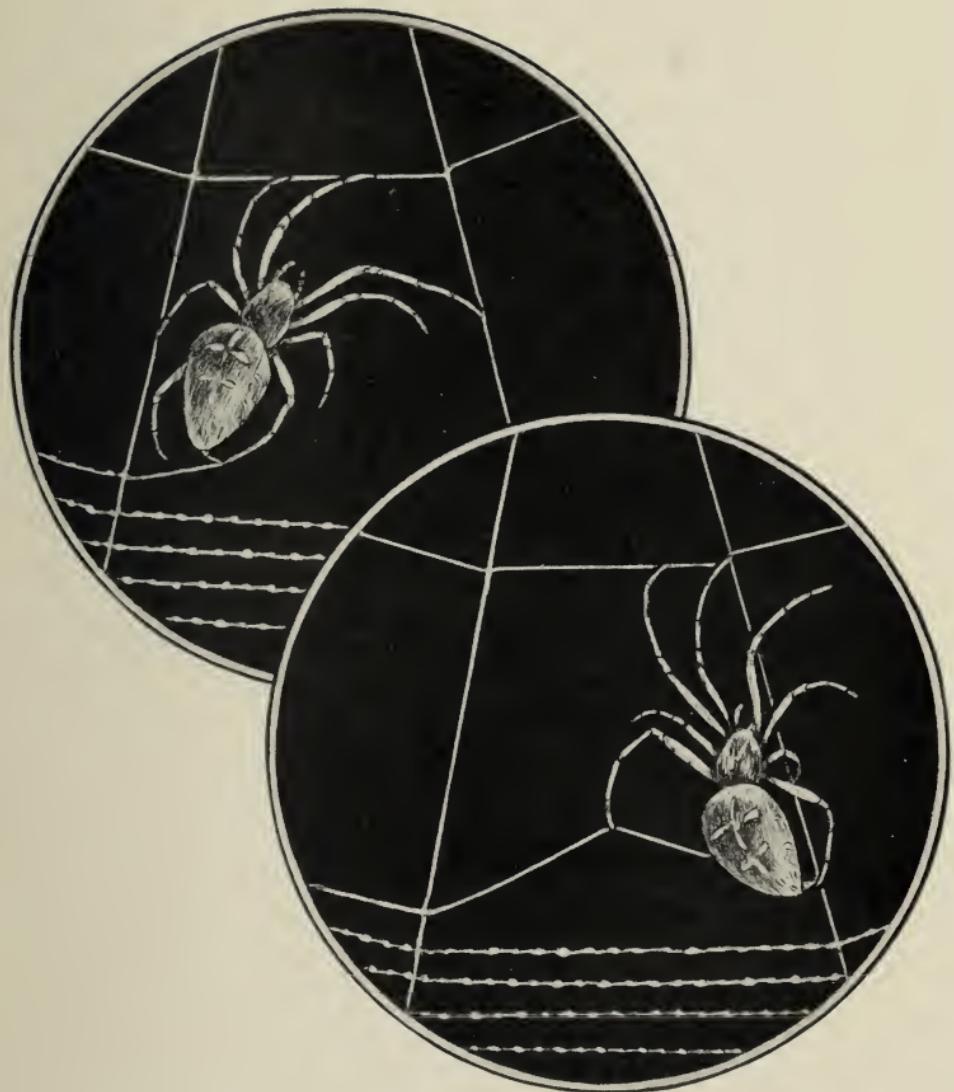
The following incident, recorded by Dr. H. C. McCook, shows how rapidly orb-weaving is undertaken and carried to completion. An Englishman, being pursued by Red Indians, sought refuge in the

hollow of an old tree. While hiding there, he saw a spider begin to weave her web over the entrance. Within a very short space of time the orb was completed, and the little weaver took her station in the centre. No sooner had she done so, than a Red Indian came by. He approached the hollow tree, tomahawk in hand, but noticing the web with the spider in the centre, naturally concluded that there was no other tenant there. He therefore hurried away on his savage quest. The life of the Englishman was thus saved by the activity and skill of the little orb-weaver.

On almost any bright summer morning we may watch the whole method of orb-weaving from start to finish. The foundations having been well and faithfully laid, the orb-weaver runs a diameter line across her framework, from the centre of which she constructs her radii, like spokes in a wheel. These radii are generally put in alternately, at opposite points of the compass, so that stability may be maintained during the progress of the work.

Beginning from the hub of this many-spoked wheel, the spider braces up her framework by a few concentric rings. These rings form a notched zone in the centre of the orb web. Over the remaining portion of the web the spider lays down a few lines of ordinary silk, to serve as scaffolding for future operations. Everything is now in readiness for the most important feature of her snare, namely, the spirals of sticky beads which are to entrap her prey.

Working from the circumference towards the centre of her snare, the orb-weaver lays down her



PUTTING IN THE VISCID SPIRALS

viscid spirals with remarkable regularity and extreme care. She swings from point to point on her scaffolding, fastening in the spirals with her spinnerets, till at length she comes back to the central mesh-work of her snare. In weaving a full-orbed web, a spider will make over a thousand attachments of the viscous threads to the radii. I have noted as many as eighteen hundred in a Diadem Spider's orb. Yet all is done with such dexterity and precision that the whole snare will be completed well within the hour.

The viscous spirals are formed of a different material from that which composes the framework. A gummy substance evenly covers the threads as they issue from the spinnerets. This substance very quickly forms itself into globules along the lines. These beads when magnified appear like beautiful pearls, strung in regular order upon a double thread. Under the influence of rain the viscous pearls are found to dissolve. A snare begun before, and completed after, a shower, will present a curious effect, part being adorned by the pearls, while the rest of the web appears to be wrought of plain threads. If preserved from any disturbing influence the threads will remain viscous for several months.

The gummy beads of orb webs are formed in quite a simple way. Holding the line taut with her hind foot, the spider passes from one radius to the next. Just as she is about to fix the line in its place she deliberates for a second, as if to test its elasticity. The thread is then quickly fixed by the spinnerets, and suddenly released by the foot, when it springs into position. As the line is stretched taut the gummy material forms itself into masses

more or less globular, finally assuming the bead-like form.

A similar result has been achieved by trying the experiment of drawing out fine threads from molten quartz and placing oil upon them. The oil assumed the beaded form of the gummy material of the spider's snare when the thread was drawn taut and shaken, after the manner of twanging the string of a bow. The experiment can be tried any day by taking a piece of fine elastic, covering it with gum, and drawing it tight; globules will at once form upon it.

The spider has other ideas concerning her pearls besides those of adornment when she places them on her lines. Hers is a purely practical point of view. The little spinster, like a discreet housewife, fashions her snare with careful forethought for the enrichment of her larder. The beads are very sticky and act like bird-lime on any unwary victim. The gummy substance adheres to the insect's wings and legs, and holds the captive fast, till the bloodthirsty creature is able to issue from her retreat and secure her prize. She speedily envelops her capture with a shroud of silk, cast from her spinnerets by her hind legs, and conveys the prize, securely trussed, in triumph to her bower.

A full-orbed web, laden with dew, is an object of great beauty as it glistens in the sunshine of an early autumn morning, every strand hanging with radiant dewdrops, the whole a rich necklace of gems. The moisture thus brought to the spider's dining-table is possibly utilised by her to satisfy her thirst, for these creatures seem to require

TRUSSING THE VICTIM



THE ENTANGLEMENT



water to slake their thirst, in addition to the juices of insects.

The weight of the dew must bring upon the web considerable strain, which is largely overcome by its extreme elasticity. The strands, also, through their method of construction, are endowed with great resisting power. I have seen a large bee held captive by means of a single strand of an orb web, through the barbs of the bee's sting catching the lines of the snare. Although every other part of its body was free from entanglement, and it exerted itself to the utmost to wing itself away, it still remained anchored in this curious fashion. However, in pity for the captive, I severed the thread, and the bee flew off, trailing behind it a streamer of silk.

We sometimes see small stones, or pieces of mortar, attached to foundation lines of orb webs. It seems as if in such a case the weaver had fastened her line to the stone while it lay on the ground ; then, in the process of putting in the other lines of the snare, or by contraction in drying, the original foundation cable had become taut. The pebble or other substance thus becomes lifted from the ground, and sways to and fro in the spider's snare.

I once found, in my garden, the foundation lines of an orb web being utilised in a novel way. Some caterpillars of the large white butterfly had exhausted their food supplies upon a nasturtium bed, and desired to emigrate to pastures new. They discovered that an orb web bridged the gulf between them and a delectable region three feet away. The foundation lines stretched from the old domicile to

the new, with an elder bush as a half-way station. Some fifteen caterpillars followed, one after the other in quick succession, across this frail suspension bridge, covering the spider's web with their own silk, as they went. The spider could make nothing of this strange incursion into her domain, and sat in consternation and wonder till the procession had passed by.

When but little interfered with, a snare will be left to do service for several days. On the other hand, when broken by wind or prey, it will be renewed every evening, or, perhaps, early morning. One outside my window always presented a perfect appearance every morning. Currents of wind through the window, on its being opened, generally made havoc of the snare, and by evening, between wind and insect prey, it was in sorry plight. Nevertheless, every morning found the web perfect and the patient weaver hopeful and expectant.

When autumn leaves have fallen and all Nature seems hushed in anticipation of the winter's rest, the spider passes into retirement, or languishes upon her egg casket, true to her motherly instinct even unto death.

When the flowers of the field awake in spring, and carpet our woods and downs with their beauty, the little folk of Spiderland awake with them, true children of the sunlight that they are, and the busy round of life begins afresh.



A NETWORK OF GLISTENING DEW PEARLS WITH
SPIDER'S BOWER ABOVE

CHAPTER V

THE SPIDER AT HOME

THE Anglo-Saxon word for "spider" is "coppe," whence comes the term "cobweb," meaning "the web of the spider." Cobwebs are wonderfully ingenious and artistic, and exceedingly varied in their style of architecture. The work of orb-weavers, lace-makers, sheet-weavers, feather-stitchers, tube-weavers and tunnel-makers, forms a most interesting subject for Nature study. It is only possible to notice the work of a few of the more interesting and typical, for the nets, webs, snares, gins, traps, and retreats of Spiderland are wellnigh infinite in their variety.

The sheet web of the house-spider is an object, perhaps, all too common, and has, by its obtrusiveness, no doubt brought spiders generally into disrepute. The common house-spider always seems to me to be something of a heroine. She weaves her snare and sits patiently within her tubular retreat, to catch nothing, perhaps, but dust or the housemaid's broom. How she manages to live I cannot understand. But her powers of endurance are great.

Thomas Edward, the Scotch naturalist, has recorded the astonishing fact that a domestic spider

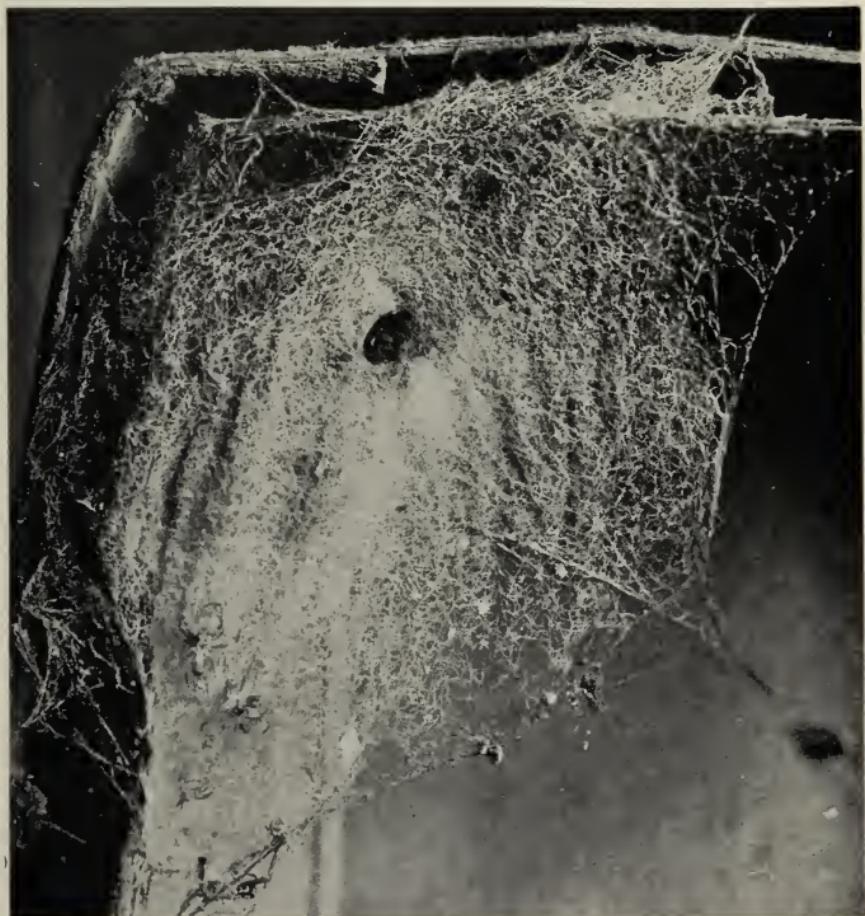
lived in one of his cases of birds for twelve months without any trace of food whatever. The spider was sealed up with the stuffed birds, and, after a reconnoitre of the premises, accepted the situation in a philosophical fashion after the manner of its kind, taking up its station in a corner of the case. Here it spun its snare ; then it proceeded carefully to inspect its handiwork, giving especial attention to the aperture, or den, which, as Thomas Edward observes, "serves at least the fourfold purpose of storehouse, banqueting-hall, watch-tower, and asylum in times of danger." Here the solitary creature established itself as sentry, to watch for the approach of any victim. Its patient vigil was never rewarded. There was nothing to be caught. To all appearance it was the only living creature in the case. Here it spent an existence, hardly to be dignified by the name of life, for over twelve months, without a solitary fly to appease its voracious appetite, or a drop of dew to slake its thirst. From this instance we may dismiss at once the ancient myth, that a spider shut up without food for a year will turn into a diamond !

Once fertilised a domestic spider will lay fertile eggs each year for about four years, should kind fortune permit so long a sojourn in peace. The length of the spider's thread of life is not, on the average, so long drawn out, but varies according to conditions of climate and powers of concealment. A Tarantula, carefully fed in confinement, has been known to exhibit its gratitude by living till it was at least nine years old.

The Labyrinth Spider's sheet-web is an object



HOUSE SPIDER



SHEET NET UPON THE EDGE OF AN OLD BOX WITH
SPIDER'S CAST-OFF JACKETS IN THE LOWER CORNER

that frequently arrests our attention by hedgerows and running water. The workmanship is most elaborate, taking many hours to complete. To watch its progress is very interesting. It passes from the condition of a fine network of lines to that of a delicate silken veil; then to that of a pure white muslin sheet. Within the oval retreat of the snare the weaver lurks, in readiness to sally forth upon any luckless victim that may happen to fall within the scope of her labyrinth.

The fine network of the snare, represented in the photograph facing p. 38, is really a beautiful object. The weaver must have expended a great amount of time and pains over a piece of workmanship so well woven. She seems to have managed to have preserved it through a period of five moultings, for in the corner of her snare were five cast-off jackets, relegated, apparently, to the lumber-room.

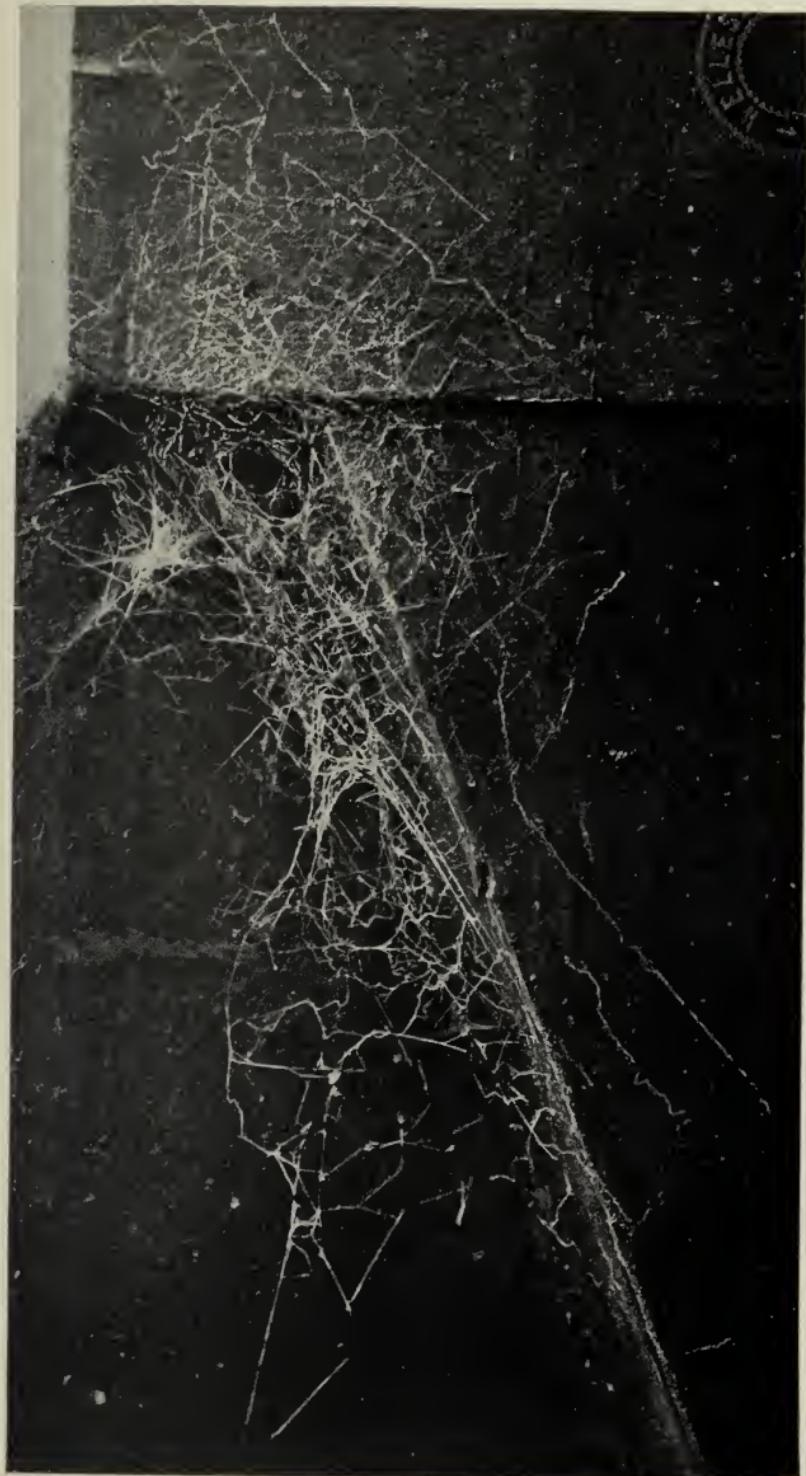
The untidy-looking network of a bluish-grey colour, seen in outhouses and upon stone walls, must often have attracted our attention. In the depths of a central cavern lurks the owner of the lace curtain, woven to catch the unwary. For the innocent-looking network, when closely viewed, is seen to be of very complex structure, and will be found to be very adhesive to the touch. The appearance under the lens is as if fine wires were festooned with finer spring wires, twisted and twined backwards and forwards in a wonderful way. The photograph facing p. 40 will convey a better idea of this structure than any description can give. The web, when seen on a dark background, seems to be enveloped in a semi-transparent, bluish material, which has a very viscid

character. The innocent-looking filaments are thus transformed into an effective snare.

Spiders that operate in this manner are found to possess an instrument like a fine comb upon the last joint but one of their hind legs. This comb, or carding machine, consists of a double row of tiny curved spines. I have made a photographic illustration (facing p. 6) of this little machine, which has the big name of "calamistrum." When these are present there will be found, near the spinnerets, a couple of narrow oval plates, by means of which certain glands, secreting viscid material, find an outlet during the process of spinning. By the agency of the fine combs the silk, as it is exuded from the spinnerets, is teased into the fine lacework which we have noted.

Moths form very acceptable meals for a hungry spider, and the relics of a feast, in the shape of the dishevelled wings of some unlucky victim, may often be noticed hanging on the outskirts of a snare; while many beetles, butterflies, and flies fall easy prey to the spider's voracious appetite during the summer months. Even the wasp, with all its show of fight, sometimes becomes a victim to the spider's superior cunning. We have often heard it said that when a wasp or bee becomes entangled in a snare, the spider is careful to sever the threads and allow it to escape. This, however, is not always so. Sometimes each falls a prey to the other's ferocity, and there is a grim satisfaction for each, while in deadly embrace, in the thought of slaying a foe.

We have seen more than one instance of the capture of a wasp, the spider proving victorious in the encounter. The performance is one of interest



A LACE CURTAIN WOVEN FOR THE UNWARY



to witness. The lace-weaver, in one instance under observation, seemed to realise the ticklish business upon which it was engaged, and was circumspect in keeping well away from either end of the wasp. The spider seized her prey by the wing, which she fastened down. Then she gradually drew nearer and nearer the body of the victim, while the captive kept up an incessant sparring with its scimitar-like sting. This display of energy proved all to no purpose. The deadly foe crept nearer still, with the stealth of a panther, until it was enabled to embed its fangs in the wasp's body, in the region of the wing juncture. The wasp, overcome by the anæsthetic administered by its superior foe, ceased its struggles after a few twitchings. The spider then proceeded to drag her prize into the most secluded corner of her den, there to feast at leisure.

More elegant, and, perhaps, more indulgently tolerated than the snare of the house-spider, is that of our handsome garden orb-weaver, the Diadem Spider. This name, as well as that of "Cross Spider," is applied to this species by reason of the pattern on its back, which is formed by several white spots, more or less regular in shape.

The Diadem Spider spins a full-orbed snare; that is to say, all the spiral lines cross the radii, or spokes of the wheel-like web. She presents a pleasing picture as she sits at the hub of her ample snare, in touch with her own narrow world, ready to claim any prize that may fall to her lot, or to seek refuge from the many foes that perchance may assail her.

The orb-weavers represented in the photographs facing p. 42 were personal friends. They lived with

me for months. They would do anything almost that I wanted ; would feign death if I coughed, sit for their portraits, take flies from my fingers, make a public demonstration of the trussing of victims, and display a fine indifference to the public gaze at dinner-time. A good deal of entertainment may be obtained by domiciling a garden spider or two in a more or less circumscribed area, such as a greenhouse, and keeping a watch from time to time upon the various operations of snare-weaving and prey-catching.

When the weather is fine, business becomes brisk in Spiderland. In the season of abundance, when there is a good run of captures, a little canning of surplus food is instituted by the careful housewife. The insect under this operation is completely enveloped in flocculent silk, which is rapidly emitted from the well-opened spinnerets, and cast over the unhappy victim by means of the spider's hind legs. After being trussed and spun like a fowl on a spit, the capture is hoisted out of the sphere of operations for cold storage in the larder, whence it is fetched as occasion requires. Thus is provision made, literally, for a rainy day, for in Spiderland rain is a serious obstacle to business. After a shower the viscid material is, to a large extent, washed from the lines, and often the web is broken down hopelessly.

During rainy weather, or when storms threaten, the snares hang loose and neglected, while the uncomplaining spinster awaits patiently within the shelter of her bower the dawn of a brighter day. Trials affect not, nor do fasts disturb, the even balance

of her mind. When the skies clear and the sun smiles upon the earth she again takes up the thread of her operations, and prosecutes her task with a dispatch that suggests a full and ready determination to redeem the time.

Many spiders carry on their spinning work under cover of darkness. The weaver is guided, not by sight, but by touch, in the construction of her snare. Dr. McCook records that on one occasion the skipper of a yacht on the St. Lawrence river complained of the nuisance of spiders' webs, which decorated his vessel every morning, though each day they were cleared away. They seemed to spring into being like mushrooms, under cover of night, and yet the spiders were nowhere in evidence in the morning. A careful search, however, cleared the circumstance of all mystery. The spiders concealed themselves with great care, in the daytime, in the corners of the woodwork and under railings, and only came forth from their hiding, like guilty stowaways, when night fell.

It may often be noticed that the orb-weaver, as she sits within her snare, holds the radiating lines taut as they converge upon the centre. She is thus enabled, by means of her sensitive feet, and the touch hairs with which they are adorned, to detect the slightest movement in any part of her web. In her bower of leaves, the patient watcher waits, like a faithful sentinel, ready at the first warning to respond to the vibrations of her trap line. This line is connected with all the main radiating lines of her snare. By grasping the trap line, while she is in hiding, the spider is able to locate vibrations

caused by ensnared insects, even though they are well outside her range of vision.

The orb-weaver's power of vision is by no means great. It may often be noticed that unless the lines of the snare are agitated when prey becomes entangled, she sits placid and unconcerned. Should the vibrations that may have been set up cease before she is able to reach her quarry, she seems at a loss to locate its whereabouts, and clutches and springs her web again and again. Failing any response, she returns with an air of disgust to her hub.

By her quick power of touch, the spider lives in constant telepathic communication with the various points of the compass of her snare. If we observe the way in which a spider sits, with her feet on the radiating lines of her web, it will be no surprise to find that disturbances are located with unerring precision. The spider's delicate sense of touch is the directing force of her activity, in the construction of her snare, the weaving of her cocoon, or the enshrouding of her captives.

Touch ever so lightly one of the spines of the orb-weaver's fore-legs as she hangs upon her snare, and out will go these secondary feelers in an inquiring fashion. The whole skin of the spider is a vibroscope, delicately attuned to any tremulous motions around; and tactful vibrations, too refined for human sense to appreciate, are perceived in a marvellous way.

The cave spiders that live in the eternal darkness of American caverns are apparently devoid of organs of vision. They weave a slight web of simple



IN TOUCH WITH HER SPHERE OF INFLUENCE

lines in which they catch a few frail and feeble members of the insect tribe, groping themselves for a scanty livelihood. Amidst the delicate lines of these subterranean habitations, tiny cocoons of fine flossy silk have been observed, showing that the creatures are capable of weaving their little cocoons in the unbroken gloom of the cavern, as well as their more fortunate relatives of the light and of the day.

It is not quite clear where the spider's ears are situated. Probably their office is fulfilled by certain spines and adornments upon the legs and palps. Though the delicate formation of the feet and the many fine touch hairs they possess enable the spider to realise what goes on in her snare, there seems to be some further sense that we are accustomed to associate with hearing and smell in the higher animals. By the agency of these refined sense organs the spider becomes conscious of finest vibrations, too delicate for human perception. Pope, with the instinct of a naturalist, declares :

“The spider’s touch, how exquisitely fine,
Feels at each thread, and lives along the line.”

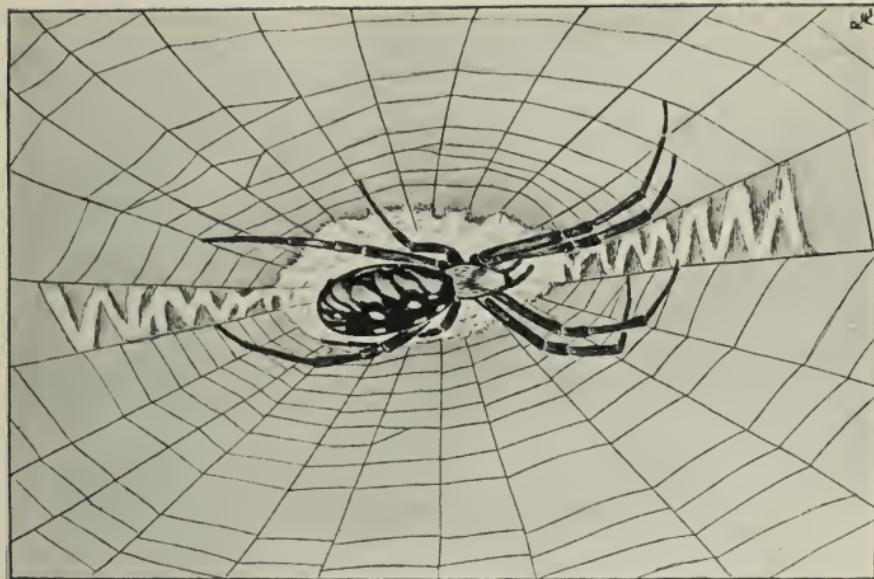
CHAPTER VI

SNARES ELEGANT

THE handsome weaver of the winding stair is one of America's largest orb-weavers, commonly known by the name of the Basket Argiope. She corresponds, in the New World, to the Diadem spider of our English gardens. Her cocooning work has already been noticed, for it is she that weaves the beautiful flask-shaped cradles which we have figured in the course of making.

The peculiar feature of this orb-weaver's snare is the white, silken shield which adorns its centre, gradually merging into the radii, to which it is fastened. Above and below there is a broad, zig-zag ribbon of fleecy silk webbing. These special adornments of the web are put in as a finishing touch to the snare. In order to form them the spider opens all her spinnerets to their fullest extent, and draws out streams of fine flossy silk. This silk is first woven over the central meshwork to form the shield. Afterwards the winding stair is placed in position, between two central radii.

This handsome spinster loves to swing, head downwards, upon the central shield, to which she anchors herself by her spinnerets. In this position she is ready to drop from her snare should danger



ARGIOPE'S CENTRAL SHIELD AND
WINDING STAIR



WEAVING THE WINDING STAIR

threaten. As the larger, and more exposed, portion of the web is below the silken shield, she is also in the best position for the capture of prey. In the event of an unlucky victim approaching too near her silken domain, we may imagine the wily hostess declaring :

“The way into my parlour is up a winding stair,
And I’ve many curious things to show you when you’re
there.”

The purpose of the silken shield and feather-stitching upon the web seems to be to give the spider firm foothold in dealing with captures. Should they prove especially formidable, the mass of flocculent silk, thus ready to hand, will be used to enshroud them. The central spinning work not only adds strength and durability to the web, but it also serves to safeguard the spider from the attacks of foes from behind. When alarmed the owner will be seen to hurry round from the front to the rear of her snare, thereby securing the protection the shield most effectively affords.

The beautiful orb-weaver known in America as the Banded Argiope is the builder of the canopied cradles we have noticed. She adorns her orb with thickened flossy cords, which are sometimes placed in semicircles around the centre, and sometimes above and below it, giving it a handsome appearance. She delights to weave her web amongst tall grasses and upon hedges, in late summer. This queenly weaver presents a striking picture of spider life, as she sits, with head downwards and legs extended, at the hub of her decorated orb, awaiting the reward of her honest toil.

Her mate is vastly inferior in size, and presents one of those many contrasts between the male and female to be found in Spiderland. He must needs proceed with extreme caution as he ventures within the precincts of his partner's ample domain. He moves with fear. He walks humbly in her august presence. He is, in most instances, a poor weakling of very insignificant proportions compared with the lady of his choice. The mere man may well congratulate himself that his lot is not cast in Spiderland.

Love making in the spider world is a delicate and dangerous undertaking. Domestic relations can hardly be said to be on a satisfactory footing. "Love me or I die" may be literally and painfully true from the male point of view. The swain runs a serious risk, should his overtures be slighted, of sacrificing his life for love, his lady-love often testing the state of her suitor's heart by sucking his blood. Her lord is, consequently, always on the alert, ready to beat a hasty retreat at the first sign of disapproval on the part of the mistress of the house. His enemies are, of a truth, they of his own household.

The little fellow may be seen, housed in a modest lodging of his own, or hanging about on the outskirts of his mate's more ample abode. In the centre of her domain his portly wife takes up her position, while he makes himself scarce, hardly daring to call his soul his own. To her lord falls the lot of picking up unconsidered trifles; acting, for the most part, like the pariah dog of an Indian village, whose habit it is to prowl around the houses,



THE MALE SPIDER LOUNGES AROUND UPON THE OUTSKIRTS OF HIS LADY'S DOMAIN

and content himself with a stray bone from the rubbish heap.

It is as much as his life is worth for the male spider to incur his wife's displeasure. The chances are that he may find himself trussed like a spitted turkey, with little ceremony, and left till dinner-time. Then, after the table is cleared, in some secluded corner of her domain, will be found, in shroud of silk, a fitting memorial to the dear departed. An eye-witness of such a proceeding says : "Perhaps overpowering hunger compelled her to do it, but the act was very ferocious." The rights of the fair sex of Spiderland may well be said to be asserted with brutal ferocity.

This unhappy state of domestic affairs is not universal in Spiderland. To some spiders the name of "benignum" has been applied, because they are so remarkably benignant in disposition that husband and wife are able to live together without eating each other up.

A common visitor to our gardens and outhouses is the sectoral orb-weaver, so named because a sector of the web is left open, and entirely free from viscid threads. Through the centre of this open space, a trap line runs, connecting the hub of the web with the spider's retreat. This retreat assumes the form of a little tent, or silk-lined tube, woven among irregular lines, in some sheltered corner a few inches away. The spider sits, head downwards, under cover of her tent, and holds fast the trap line, awaiting patiently hour by hour the approach of prey. Directly the snare is touched, however lightly, the trap line is set vibrating, and down comes the

spider along her threads, breathing out destruction upon her hapless victim.

The name of Triaranea, by which this spider is known to naturalists, signifies that it possesses the threefold powers of orb-weaver, line-weaver, and tube-weaver. The line-weaving is more or less marked, according to the particular conditions under which the spider has to labour ; but the tube is always present, generally at the upper portion of the snare. The viscid threads of the snare are fixed in position as loops, not as spirals, the weaver, on reaching the open sector, returning to and fro upon her course.

Often exceptional circumstances arise which call forth the ready wit of the spider, in adapting herself to the needs of the case. The spider, by putting two and two together, generally gets the sum right. A Diadem spider, whose habit it is to sling a full-orbed snare, found herself in a position where she could not run a foundation cable for the lower portion of her web. She therefore made a sectoral web, like that of Triaranea, leaving out one-third of the orb on the lower side. The web, when finished, suggested the appearance of a round pie with a large helping removed. This power of adaptation to circumstances was demonstrated also by another spider in a tight corner. A little Triaranea, whose custom it is to make the sectoral web, was found to have made a small triangular snare with only five radii, converging to a point. Apparently there is no blind law of necessity governing the ways of the spider world. The power of reason appears to be present in a remarkable degree, when one orb-



A SECTORAL WEB SPANNING AN OPEN DOORWAY

weaver, having space for only a section of a web, contents herself with that, while another, finding she cannot construct a full orb, as her custom is, accepts a new situation, and goes to work accordingly.

When once a site has been chosen, the spider's sense of the economy of labour is shown by its habit of rebuilding its snare again and again over the same area, at the same time using the original foundation lines. The ruins of the old webs can be seen as they have been successively thrust back out of the way.

The web of Triaranea, the sectoral orb-weaver, often forms a very symmetrical and beautiful object, as it is seen framed in a triangle of foundation lines and slung in a corner of a wall, or cast in the angles of railings, or glistening upon the framework of a doorway where a good opening is afforded for earning an honest living.

A drone fly affords a mighty feast for such a tiny spider as Triaranea. It argues the possession of considerable courage on the part of this little spider, one-fourth the size of its victim, in attacking and effectually securing such a prize. One of the photographs facing p. 52 shows an attack of this kind. The spider seemed to scent danger, so kept well away from either end of her victim, for we can hardly expect the spider to be able to detect the difference between a drone fly and a bee. She went to work discreetly. She first secured one wing, then the other, and flung herself bodily upon her captive at the juncture of the wing with the body. Here she was able readily to penetrate the

skin and find an entrance for her poisonous fangs. The spider then sat down to her well-earned feast.

It is interesting to watch the method by which a small spider conveys a large capture to her den. Finding it too heavy to carry in the ordinary way, she first cuts away the entanglement about the victim, save the upper threads. She then levers it up the distance of its own length and makes it fast, reminding one of the way our luggage is trundled along on the platform of a railway station. The lower anchorage is again cut away and the hauling continued. This process is repeated five or six times till the retreat is reached and the prey safely landed.

We naturally look for the largest representatives of the orb-weavers where insect life is largest and most abundant, namely, in the Tropics. In the depths of the Indian jungle, or the forests of Africa and South America, the dimensions attained by spiders under the most favourable conditions conceivable are very considerable. As one traverses jungle paths one is often confronted with a huge web as big as a cart wheel ; this will be found to be secured in position by wide spreading supports, like miniature tent ropes, as thick as sewing silk, extending twelve feet across the forest path to neighbouring trees.

The snare is composed of silvery-grey spinning work braced up at intervals with elastic golden threads of a notched pattern. The web is sectoral in form, lacking the cross-lines for about one-sixth of its circumference. Instead of taking a continuous spiral journey, like the Diadem spider, in the con-

TRIARANEA ENJOYS A SUBSTANTIAL
MEAL



TRIARANEA SECURES A VICTIM



struction of her snare, this denizen of the jungle passes backwards and forwards over her framework, putting in loops instead of spirals.

So strong is the snare of this weaver that a traveller found on one occasion, while passing through the jungle, that it bore the weight of his light straw hat. A naturalist, who has travelled in Jamaica, considers that, though these webs are capable of resisting great pressure, it is improbable that the rapid flight of even a humming bird can be arrested by them. It is a mistake, therefore, to conclude that these gigantic snares are laid for such prey. The giant orb-weavers of the forest live on dragon flies, locusts, grasshoppers and other large winged insects such as there abound. They sadly lack the courage that their substantial proportions and ample snares might lead us to expect them to manifest. Should a large insect, falling into a net, make a bold fight for liberty, the spider, a timorous creature, will forsake her prey and quit the field.

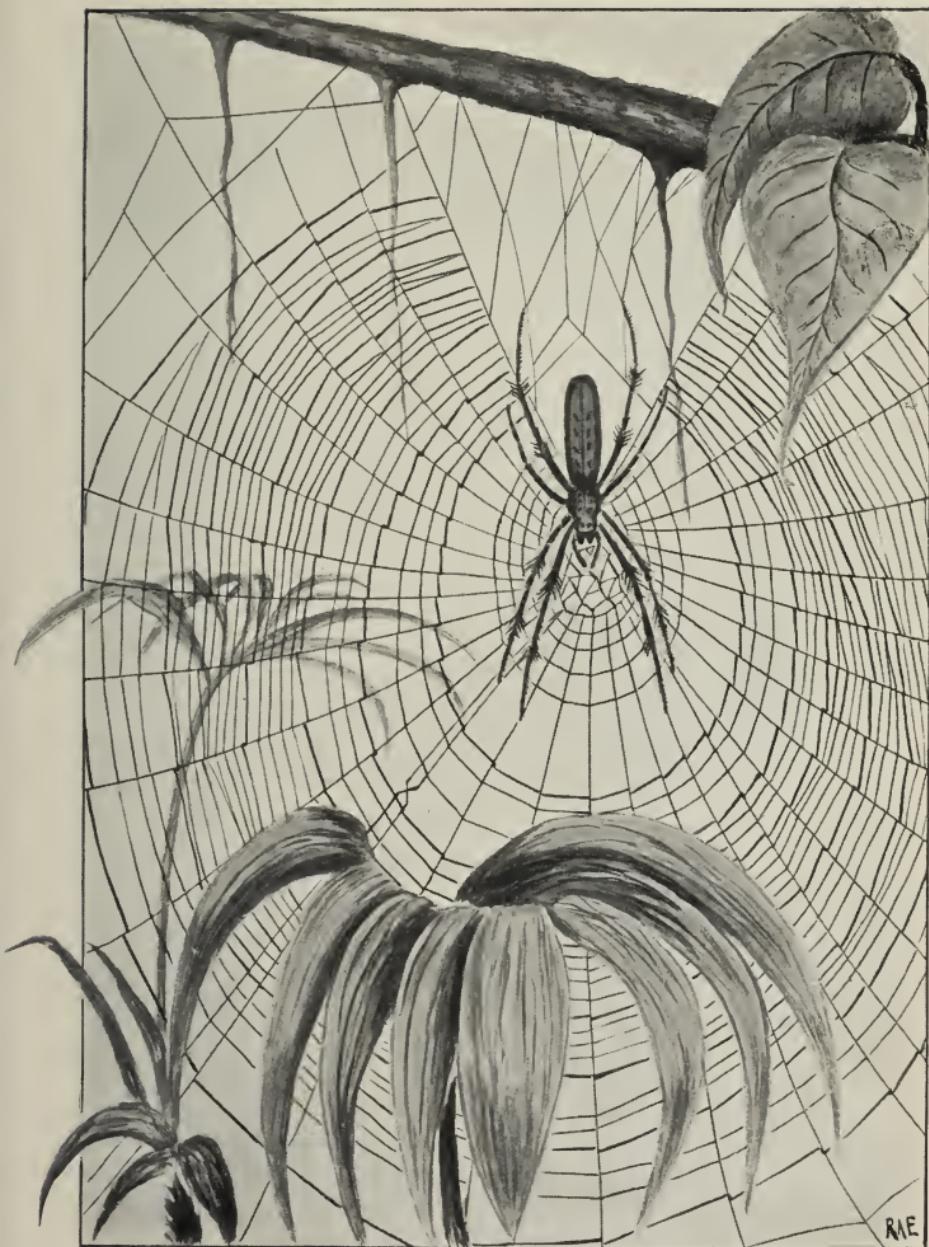
It is true that birds have occasionally been discovered in spiders' toils. Bates tells us, in his record of travel on the River Amazon, that a couple of finches the size of siskins were caught, not in an orb web, but in a dense white web, stretched across the deep crevice of an old tree trunk in South America. Other instances of a more or less reliable nature are on record. Dr. McCook tells us that, on one occasion, a mouse was found hanging in the strong lines of a spider's snare in Kentucky. He also mentions the fact that, on two occasions, small snakes were found entangled and slung up in spiders' snares. But as these were only three inches

in length, of the thickness of worms, our wonder wanes.

We may conclude that, though such instances as the capture of birds in spiders' snares may prove that the webs are sometimes of great strength, we are hardly justified in forming the general conclusion, from isolated cases, that the spider feeds upon such prey. Its normal food consists of the juices of insects, for the consumption of which it is admirably suited by Nature.

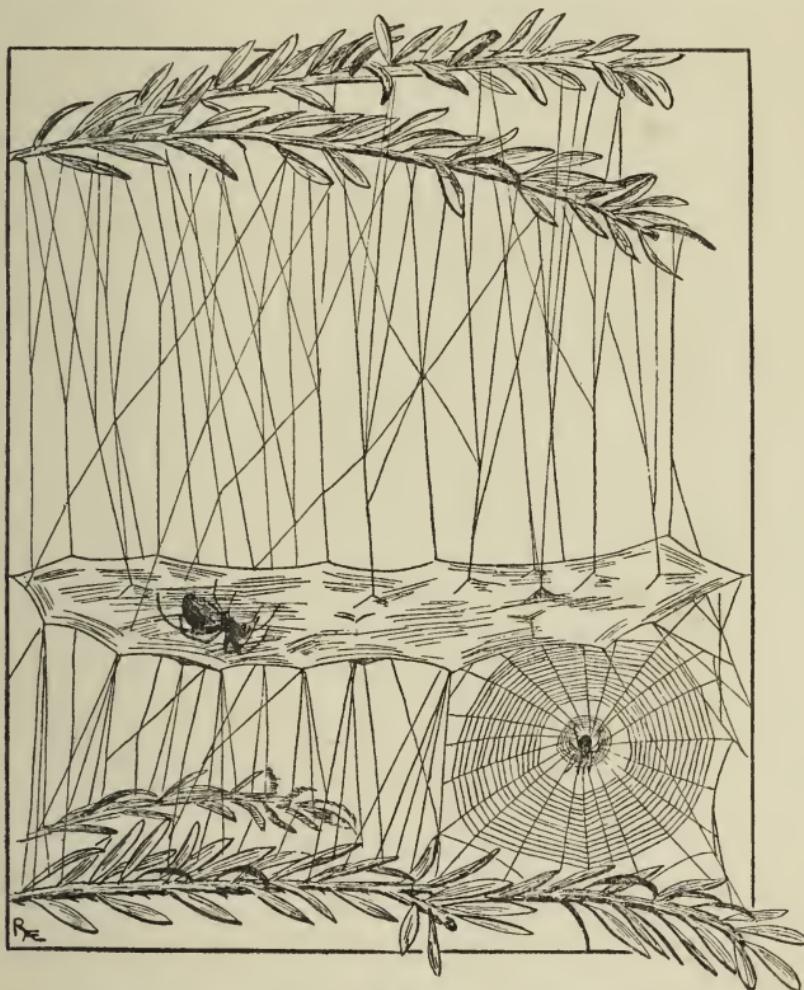
The great and the small of Spiderland are sometimes to be seen carrying on a joint stock concern in perfect harmony. The thicker strands of the larger kinds of spiders afford a ready foundation for the spinning work of such tiny species as are of a social turn of mind. The owner of the smaller business very probably finds protection from assailants in the near presence of its more formidable patron. The friendly relationship is possibly, in the first instance, of purely a business character. The wide spreading foundation lines of the larger species afford the small weaver a wider scope for the ensnaring of prey, which she is not slow to appreciate. It may be that she seeks to profit by the crumbs that fall from the table of her more favoured friend.

This happy state of co-operation and fellowship is met with in various walks of life in Spiderland. In the thick golden strands of Plumefoot, the queenly weaver of the jungle paths, will sometimes be seen the snare of a tiny silvery orb-weaver. It is not rare to find the web of a sheet-weaver of our gardens utilised by a small species of orb-weaver as a foundation for her snare.



A DENIZEN OF THE JUNGLE

Two Labyrinth spiders have been found to have set up co-operative housekeeping, their domiciles joining one another after the manner of semi-detached

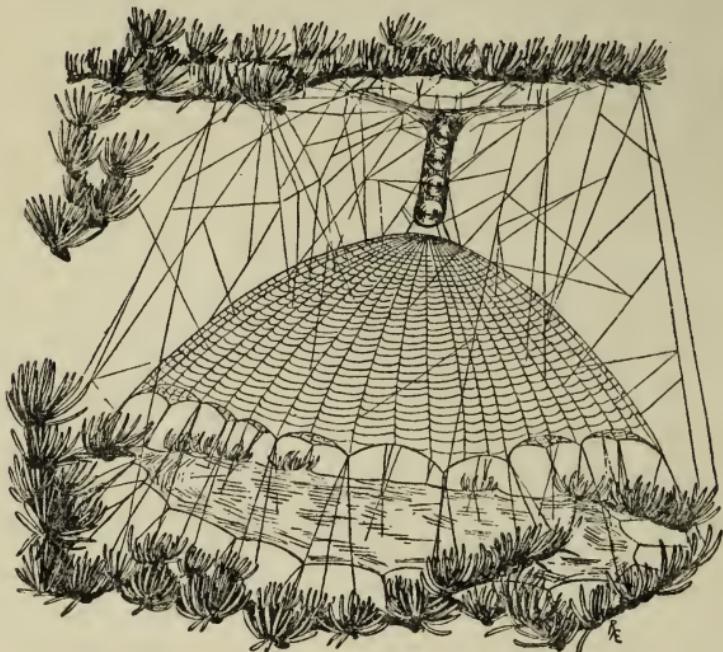


Sheet-Weaver and Orb-Weaver in partnership

suburban dwellings. The snare of the Labyrinth spider has been found so interlaced and mixed up with that of a sheet-weaver that it was quite impossible to tell where one left off and the other began. Contrary to the principle that two of a

trade seldom agree, we find the utmost harmony existing, and doubtless both manage to earn a living wage.

M. Simon, the eminent French naturalist, has pointed out, in regard to a species of orb-weaver of South America, a peculiar form of the communal life of spiders. By the united efforts of several



A dome-shaped snare

females at the season of egg-laying, a large woolly nest is woven. In this chamber they all lay their eggs, and hang them up in small round cocoons. As many as ten of these little cocoons have been found, enclosed in a single common cradle, "five or six females sharing together the cares of maternity."

Among snares elegant, one of exceptional symmetry and beauty is the dome-shaped snare of a



HAMMOCK SNARE OF THE LINE WEAVER



ORB-WEAVERS, WHEN ALARMED, HABITUALLY DROP AMONG THE FOLIAGE, WHERE THEY FIND SAFETY IN QUIESCENCE

handsomely marked little spider of Texas. The name of "Basilica" has been given to this weaver, from the likeness of its head and markings to those of a snake.

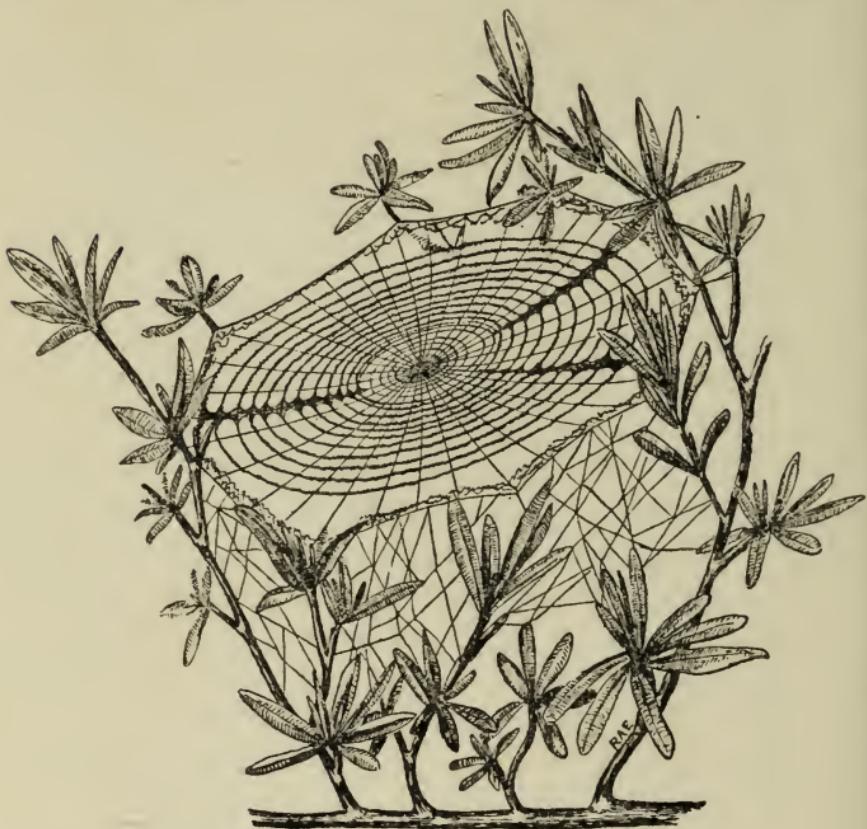
The manner of construction of the dome-shaped snare is as follows: An orb web is first stretched horizontally in the branches of a tree. By the aid of cables drawn taut above and below it assumes the beautiful form of the dome, which so delighted Dr. McCook who first discovered it. "Of the many specimens of spinning work which I have studied," he says, "I have never seen one quite so beautiful as this." Above what he characterises as a "rare piece of spider architecture," many lines are woven into a network, where insects either become entangled or are driven into the meshes of the dome-shaped snare below. Beneath the snare is a sheet web, which seems to serve as a protection for the brightly coloured little weaver as she hangs in an inverted position on the inner surface of the dome.

The cocoons of this spider are suspended, four or five in number, in the spinning work above the dome, by the aid of strong silken strands. The position of these cocoons may be seen by reference to the illustration on p. 56.

In the structure of this elegant snare we see the architecture of the orb-weaver and line-weaver most beautifully harmonised and combined.

The horizontal snare of the Featherfoot spider is a lovely object as it sways among the laurel bushes of American gardens. On either side of the hub is an adornment of notched, ribbon-like spinning work, which greatly enhances the beauty of the

orb web. There is little doubt, however, that the weaver has in mind, not only the decoration of her snare, but also its efficiency and stability. Utility has more persuasive power with members of the spider family than artistic beauty. At the same time we



The Featherfoot's elegant snare

see intuitive art displayed, such as we are hardly prepared to find in this tiny creature world.

The concentric rings composing the snare are neither plain threads nor viscid spirals, but are formed of delicate filaments of fine silk, having a very adhesive effect upon captures. The object of



MAGNIFIED THREADS OF LACE
WEAVER



THE UNDERSIDE OF A LEAF FORMS AN
EXCELLENT RETREAT FOR A QUIET
REPAST

beauty is converted by them into an engine of destruction.

We gaze with profound admiration upon the marvellous workmanship of these frail and feeble folk. We wonder how such beautiful designs can be evolved from brains so small, and wrought with such artistic taste, and consummate skill, from material so fragile and delicate as spiders' silk.

CHAPTER VII

GINS INGENIOUS

ONE of the most ingenious inhabitants to be found in the whole of Spiderland is the spring-net weaver, or Triangle spider. It is found in woods of pine and fir, among the dry lower branches of which trees it prefers to cast its net, within three or four feet of the ground. It is a small, thick-set spider, of dull greyish or greenish brown, approximating in colour to the trees among which it lives.

The web which this spider is content to weave looks very fragmentary and incomplete. We are familiar with full-orbed webs, and webs with an open sector. Here, however, is a case in which the whole web forms but a sector of one-sixth of a circle. The comparison of these webs may be represented in this way: If we think of the full-orbed snare as a pie, the sectoral web will be the pie with a three-cornered slice cut out, and the triangle snare will be the slice.

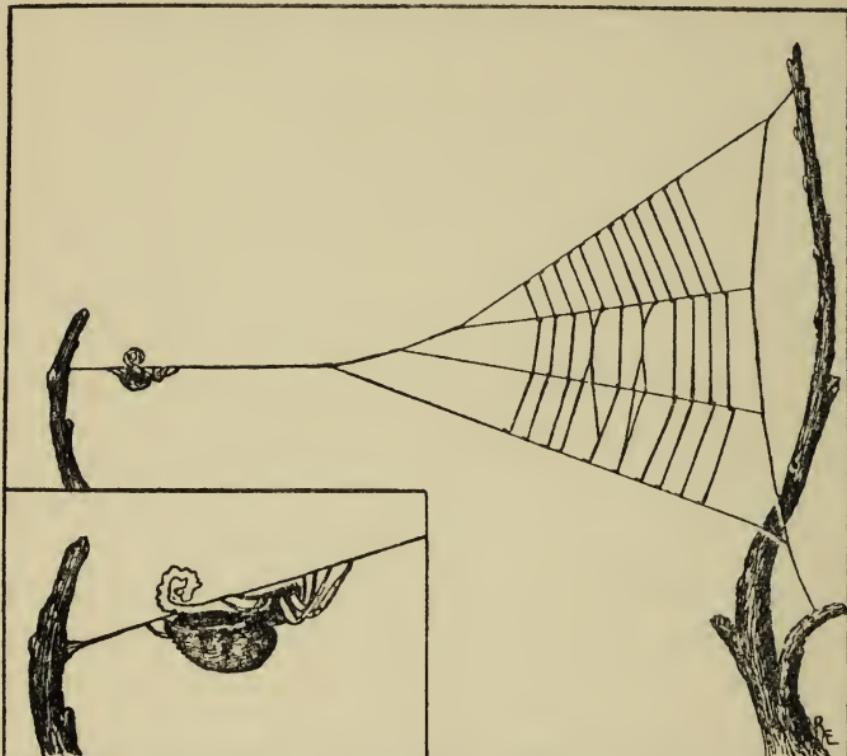
The following appears to be the method of construction: A foundation cable is stretched between two supports. To this cable three other lines are attached. The four lines approach each other at the apex of the triangle, and are united at different points along a fifth line, which forms the base. At

each corner of the triangle strong silken threads extend to keep the framework in position.

The framework is now ready for the adhesive cross-lines. These are not plain threads, like those composing the framework, nor are they beaded threads like the viscid spirals of the orb-weaver. They present a milky, flocculent appearance, and are composed of many tiny threads intertwined and teased out in the process of spinning. The spider is furnished with little sieve-like plates near the spinnerets, and rows of spines upon the hind legs, for this purpose, after the manner of the lace-weaver already described. The hind legs are applied very rapidly to the spinnerets during the weaving of these teased-out cross-lines. The peculiar flocculent nature that we notice is thus imparted to the snare. Though few in number, the threads are very adhesive, and, by their means, the utmost efforts of the boldest captive to escape are rendered futile.

It is most interesting to note the way in which the spring trap is used. The main thread, securing the apex of the triangle to the neighbouring tree, is used as a trap line. Upon this the designing architect assumes a most remarkable attitude. Sitting head downwards, facing her snare, she pulls the line taut with her stout forelegs, the slack portion being formed into a coil above the spinnerets. She thus tightens up the whole snare and converts the simple web into a deadly spring trap. As soon as the vibrating lines signal the information to the patient trapper that an insect has touched her snare, she springs her trap. This is done simply by letting go the trap line with the strong muscular forefeet

while still holding rigidly on by the hind feet. Any unhappy captive speedily becomes hopelessly involved in these meshes. In the event of a specially large and vigorous insect invading the snare, the trap line will be hauled in again and



A spring trap

sprung a second time, so as to secure the entanglement of the victim all the more effectively. The spider then secures her well-earned prize, with which she marches off in triumph.

In the formation and management of this snare, we see ingenuity and skill displayed of a remarkably high order.

Equally interesting is a small orb-weaver having

a wide distribution in the Old World and the New. It has earned the name of the Ray Spider, from the remarkable character of its web, which is to be found in wooded ravines, beside running streams, and under shelving rocks. There is a peculiar openness about the central portion of the snare, which at once attracts attention. It presents the appearance of a number of rays coming to a central point. The rays, as they spread out, are crossed by spiral lines of a viscid nature having beads of gummy material upon them, such as we find on the common orb web.

All the radial lines or rays are united up in a strong trap line, by which the web is made taut. It is fastened to some rock or plant in the vicinity of the snare, and upon it the spider takes her stand, with her head turned away from the snare. She grasps the trap line with her front legs and hauls upon it, as one would haul in a slack rope, till there is a little coil of the slack portion between her two pairs of fore legs. In the meantime her hind feet securely hold the converging radial lines, as they come together in a little foot basket. As the creature pulls upon her trap line she makes the whole web taut and bowed, in the form of an umbrella reversed by the wind.

As one watches the ensnaring of an unlucky insect, one sees the effect of this device. Directly vibrations are set up, the spider, by the sense of touch, recognises the fact, and springs her trap line by letting go with her fore feet. The slack coil quickly unwinds as she does so, and the net shoots forward, enveloping the captive in a most effective

way. The spider at the same time is jerked towards her quarry, in the manner pursued by the Triangle spider, except that she is in the reverse position. This is, however, no hindrance to her, as hers is an orb web, and she stands thus at the cross-roads of her entire snare.

The ray-weaver's web forms an interesting link between the Triangle spider's spring trap on the one hand and the garden spider's full-orbed snare on the other.

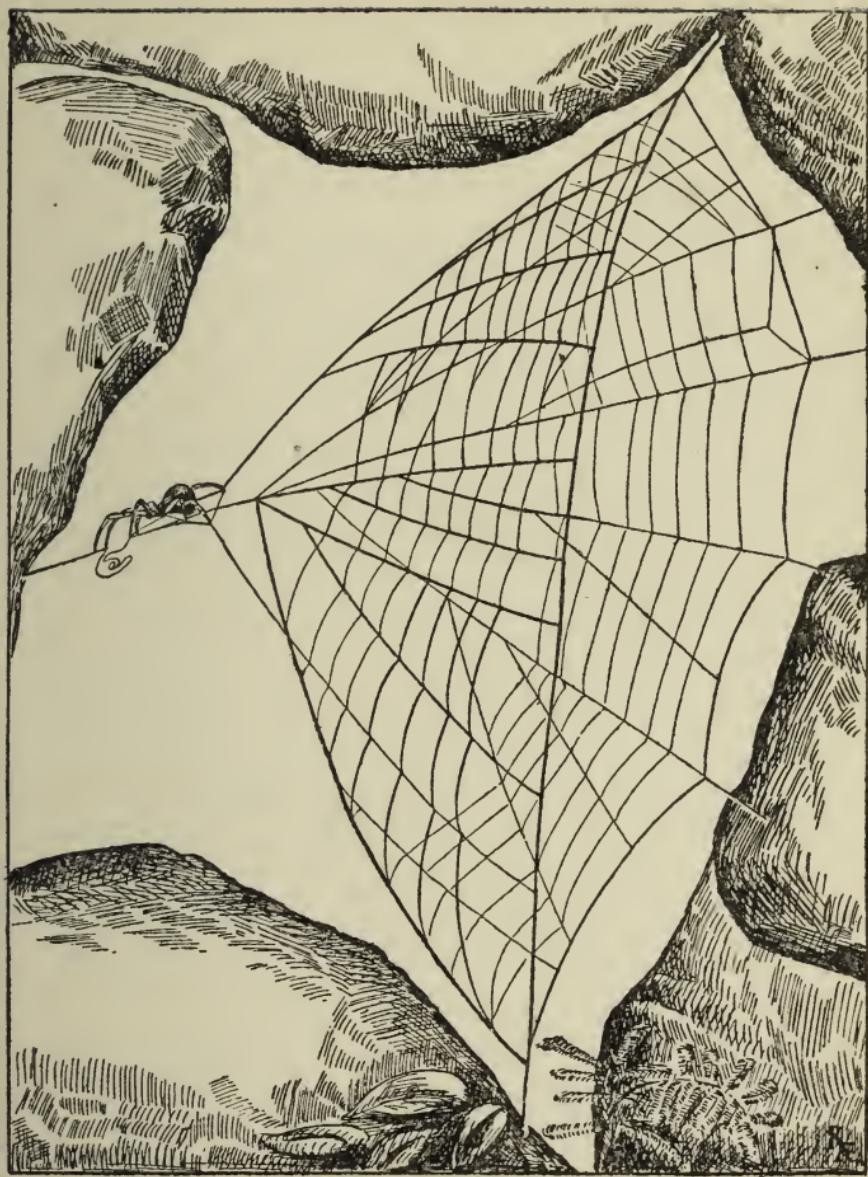
It argues no little ingenuity and engineering skill on the part of some little tube-makers of my personal acquaintance, to be able to turn a crevice in a wall into a deadly trap. Their white, rounded caves, which are represented in the photographs, present the appearance of railway tunnels, and perhaps reveal, in makers so small, equal skill in their construction.

These caverns are fashioned with no philanthropic end, but any beetle or fly seeking passage way or a refuge therein will be speedily met by the ogre of the cave and the question put, with what can hardly claim to be a real and generous feeling of hospitality: "Will you walk into my parlour?"

Quite a colony of these cave dwellings may sometimes be seen in the crannies of an old wall, or in the rotten bark of an old tree. The pure white sheeting around the mouth of the cave, and the almost perfect circle formed by the aperture, are striking features that arrest the attention of the passer-by. Frequently semi-detached dwellings will be found, or caves with a main entrance and a



PRIMITIVE CAVE DWELLINGS OF SPIDERLAND



Ray Spider's snare in rock cavity

secondary opening, which is possibly an emergency door for "exit only."

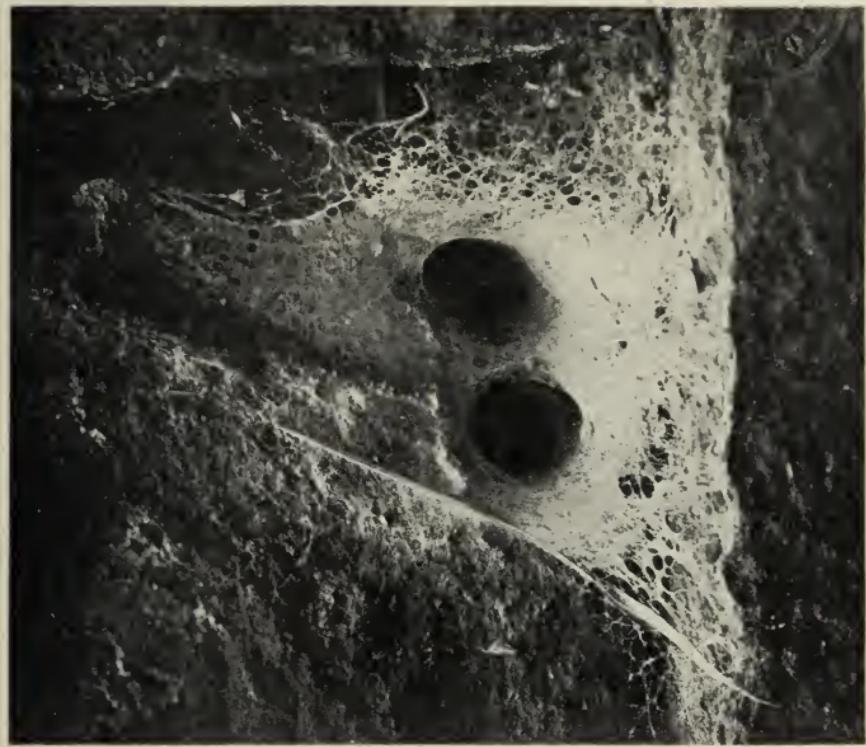
If one should feel at all curious to have a personal acquaintance with the architect, it is soon accomplished. All one has to do is to tug gently at the thick webbing in the entrance hall ; on the agitation of this communicator out will come the spider, with precipitation, from the cavernous depths, as who should say : " Who has the temerity to knock at my door ? "

The cavern is formed by a tube of thickly woven silk, three inches in length, running horizontally into the crevice. At the bottom of this dungeon will be found the debris of past feasts, shells of insects and hard wing-cases of weevils. There will probably be found also three to five white silken cocoons, containing the eggs of the mother spider. The cave-dwelling is thus a composite apartment, consisting of dining-room, nursery and reception-room.

A small wasp, *Pompilus* by name, preys upon the somewhat ferocious-looking spider which makes these cave-dwellings in old walls. Unless the wasp prove very wary during a contest, she may become ensnared in the white webbing of her prey. Then the tables are turned, and the fine fat spider, instead of serving as food for hungry wasplings, sits down, very sincerely and truly thankful, to dine off mother wasp. One could almost imagine the spider under the circumstances indulging in a sly wink.

There is a curious-looking, humpbacked line-weaver to be found in this country in conservatories and greenhouses, but never in the open

SEMI-DETACHED DWELLINGS



A CAUTIOUS RECONNOITRE



air. The little creature constructs a snare, consisting of many fine glossy lines, which intersect one another at various points and angles. The general form of the spinning work is that of a trapezium, or pyramid with the top cut off.

Hanging in the upper region of the snare may be found a number of little brown pear-shaped cocoons, the outer surface of which is closely woven, and parchment-like in texture. I have noticed that, while the mother spider hangs fondly to the last-formed of her series of cocoons, those first formed are to be seen covered with the newly hatched young. These tiny yellow and brown spiderlings present a quaint spectacle as they manœuvre about over their egg basket, their hunch-backs lending quite a comical air to the little creatures.

After keeping a freshly made cocoon for two months, I opened it, to find two hundred and seventy eggs snugly blanketed in brown flossy silk. In addition there were two baby spiderlings, just able to toddle about, as if newly hatched, two small infants changing their first skin by the gentle process of kicking off the outgrown covering with the alternate use of the hind legs. There were also eight able-bodied youngsters which had already learnt all the tricks of the trade, being able to spin and to feign death on being disturbed. I had a very grave suspicion that they had gone farther in their education and learnt the bloodthirsty business in its direst forms, for there were, besides the worn-out coats of these advanced infants, no fewer than fifteen carcasses of young spiders. These had apparently met an untimely end at the

hands and fangs of the eight young cannibals that were guiltily feigning death when dragged into the light.

The cocoon, the contents of which have just been described, was one of five, all slung in the one snare by the same spider. As each cocoon contained over two hundred eggs, we have here suggested an egg-laying capacity that is truly astonishing. The number of eggs seems far in excess of that needed for the propagation of the species, and argues that Nature makes some provision in this way for the earliest spiderlings out of the egg, till they are able to fend for themselves.

The big name, *Theridium Tepidariorum*, enjoyed by this little weaver, suggests that it delights in gentle warmth, and implies that its original home was in a sunnier clime than that which we enjoy. It therefore seeks asylum in our hothouses, probably having found its way to this country originally with exotic plants.

In the New England States a spider has earned the unenviable epithet of "Interfector," because of its habit of interfering in the domestic and business affairs of other folk in Spiderland. It makes frequent attacks on the little hunchbacked line-weaver we have just noticed, as she sits within the meshes of her snare. Bearding the lion in his den is generally a dangerous undertaking, and in this case the aggressor is sometimes the vanquished. In Spiderland the governing principle seems to be: eat or be eaten. Even the cocoons of the little line-weaver, in spite of the care with which they are fashioned, are not safe from the attacks of this voracious foe,



LINE WEAVER GUARDING HER PEAR-SHAPED COCOON

who thus exhibits a passionate fondness for fresh eggs for breakfast.

The spinning work of the Water Spider affords one of the most marvellous examples of ingenuity and skill in the spider world. This little engineer has learnt to conquer the trackless regions of the deep as easily as the ballooning spiders and orb-weaving bridge-builders conquer the air above. The diving spider spends much of her life beneath the surface of placid waters, where she may be seen enveloped in a sheen of tiny air bubbles. It is on account of this feature that she has earned the name of "Silver Swimmer." In swimming or diving she assumes an inverted position, and rests with her abdomen inside her cell and her head in the water.

The Water Spider affords one of the exceptions to the rule of Spiderland, that the female is larger than the male; for, in this instance, the proportions of the male slightly exceed those of his mate.

Much ingenuity is brought to bear in the formation of the dwelling which the Silver Swimmer makes for herself under water. It is fashioned in the form of a bell or thimble, with silk so firmly interwoven that the imprisoned air necessary for the household cannot escape. On either side the little creature is careful to run out guy-ropes to neighbouring water-weeds, in order to give stability to her abode. The nest is sometimes placed near the floor of the pond, but more generally the spider chooses a site midway between the surface and the floor.

The procedure by which the little structure is

distended with air is one of the most remarkable to be witnessed in Spiderland. The bell-diver, having completed her nest, seeks the surface, lifts the end of her abdomen out of the water, and with a jerk secures a bubble of air. This she conveys from the surface by means of her hind legs and the long hairs with which her body is adorned. Descending along the silver pathway of her threads, she arrives at her tent door; she there releases the globule, kicking it from her like a football into the entrance of her newly woven dwelling. This process is repeated again and again, until a sufficient supply of air has been stored within her habitation for the family requirements. In her subaqueous abode the little Silver Swimmer resides in perfect security and contentment. To her tent she conveys the insects upon which she preys, dining there in peace.

As the egg-laying season comes round the mother enlarges her nursery accommodation, in anticipation of the needs of her family. Her lord makes himself scarce by retiring to a separate abode, which he now erects. The egg cocoon is fastened by the mother spider to the roof of the nest. This she jealously guards, with all the instincts of true motherhood, until the nestlings appear. Here they are snugly cradled and gently rocked, oblivious of the storms that rage above, till, at length, they are able to weave their own destiny in a watery world. They soon follow the example of their parents and build air-bells for themselves. The youngsters, in the meantime, in their early attempts at house-keeping utilise the empty shells of snails, which they fill with air, according to the well-established



WATER LOVERS

family custom. Excellent shelter is thus readily provided for, and skilfully appropriated by, the young adventurers of the deep.

As the mother spider clings to her nest she takes up such a position that her breathing apparatus comes opposite the opening of her tent. She thus finds a source of respiration for herself and her family in the air she has conveyed within. At the same time, she is on guard to protect her young from any unwelcome visitor that might obtrude upon the sanctity of her home.

In the skill displayed by the Silver Swimmer, in the construction of her abode, we see human invention anticipated. The original form of the diving-bell has its counterpart in that which has been in vogue among the bell-divers of Spiderland for unmeasured ages. In the enterprise here exhibited we have an instance of the fact that man often is, all unconsciously, but an imitator of Nature's frail and feeble folk.

CHAPTER VIII

DWELLERS UNDERGROUND

THE homes of Trap-door Spiders are of especial interest, for they suggest the possession of intelligence and skill of a very high order on the part of the tiny dwellers in Spiderland. Several kinds of trap-doors are met with, varying in form from the silken wafer door to the thick bevelled door, which has attracted the attention and won the admiration of Nature lovers. There are also funnels, turrets, and purse webs, serving the purpose of doors, for other dwellers underground belonging to the spider family.

The burrow of the Trap-door Spider is a wonderful piece of workmanship. At first it is quite a tiny affair, no bigger than a crow quill, but it is gradually enlarged as the spider itself advances toward full growth. There is a double lining to the burrow, a coarse outer curtain of thick web resembling the exterior of a wasp's nest. A fine inner curtain is also spun, of silken softness, like tapestry over a coarse-grained wall.

The trap-door is composed of many layers of silk and earth, placed alternately over each other. The layers are smallest on the outside and increase in size till the innermost one is reached, which, in



NEST OF TRAP-DOOR SPIDER (FROM CANNES, S. FRANCE)
SHOWING (1) TOP OF DOOR, (2) BEVELLED INSIDE EDGE



A MOSS-COVERED FRONT DOOR

fact, marks the latest addition to the door in the process of enlargement of the nest. The earth is conveyed by the mouth-parts of the enterprising worker and sandwiched on the door between layers of silk, at each new extension of the premises. This process of enlargement will be repeated thirty or forty times ere perfection is achieved and the worker rests satisfied with the home she has modelled.

The door is fitted with a wide hinge, and has a bevelled inside edge for the true fitting of the opening it defends. There is a white silk lining to the inner surface of the door, upon which I have noticed some small punctures, which seem to indicate that the spider habitually holds down its trap-door by the claws upon its palps. The exterior exactly resembles the surface of the ground in the immediate neighbourhood of the burrow. The trap-doors are often found covered with moss or leaves, in imitation of the surrounding conditions. As the door fits close it will be readily seen how such a device may completely baffle detection, and it argues a keen intelligence on the part of the inventor of this method of concealment, which has now become apparently a fixed habit of the race.

Burrows have been found having a back door as well as a front door, and we may presume that, should unwelcome callers present themselves at the front, the ingenious householder can easily escape by the back.

Why should the Trap-door Spider exert herself to the extent she does in the formation of her dwelling ? She has need, doubtless, to protect herself from her foes ; she also requires to conceal

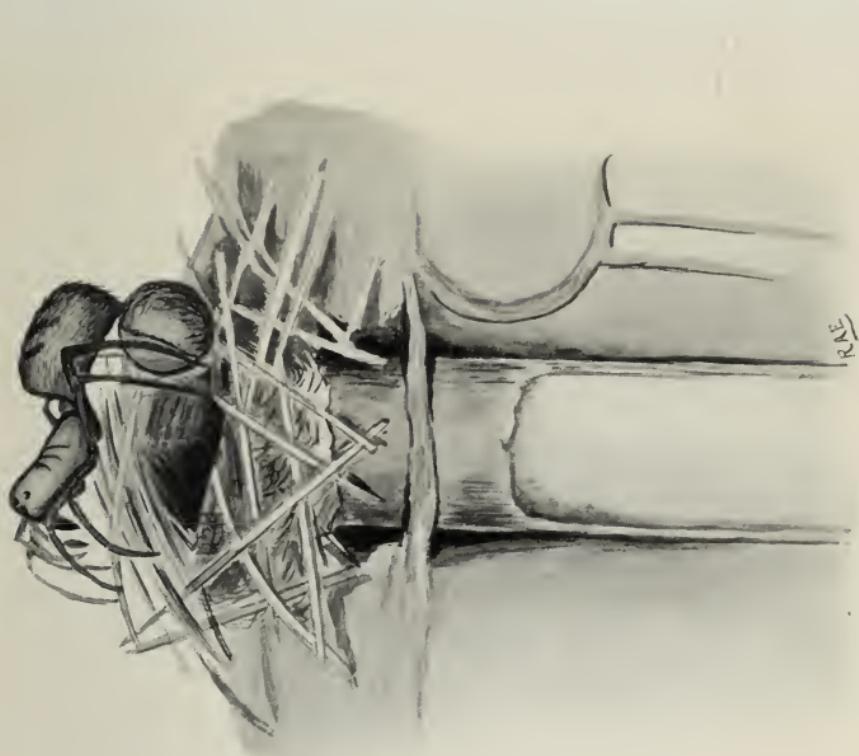
herself in order to stalk the prey which strays within her field of vision. The greatest incentive to labour and skill, however, is mother-love. It seems, therefore, that unless we realise that these burrows are nurseries for the young, as well as sleeping and dining apartments, we shall fail to appreciate the true significance of all the ingenuity brought to bear in their construction.

Some Trap-door Spiders, instead of making a thick cork-like door, construct a thin wafer-like door. Doors of this character we find among the tree Trap-door Spiders' nests. Crevices and crannies of tree trunks are used as sites, and the structures are covered over with fragments of lichen and pieces of decayed wood, so that their presence is effectively concealed from the most keen-sighted foes.

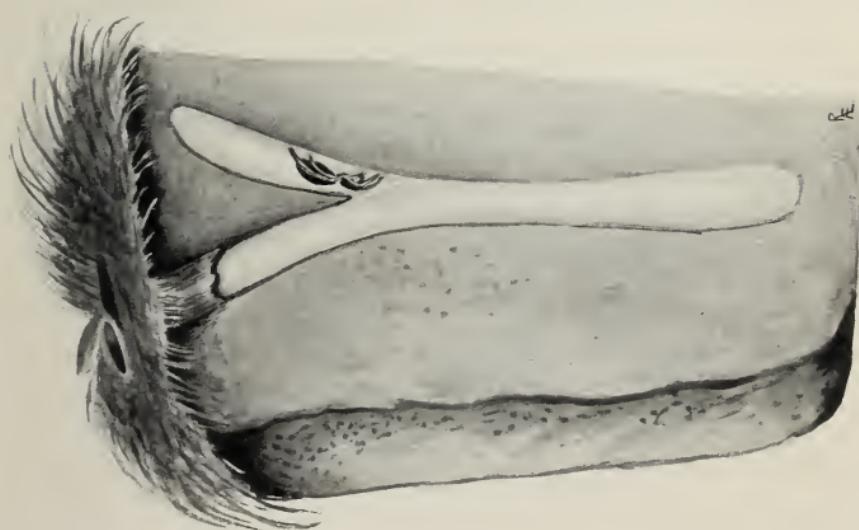
In constructing the wafer-like door, the spider first of all covers the mouth of its burrow with a thick silken sheet. It then bites away the edges adhering to the sides of the burrow, except for a short distance, this portion being left intact in order to serve the purpose of a hinge.

Among the wafer-door makers is an ingenious underground dweller which constructs a forked burrow. Branching off from the main tunnel, we find an oblique blind tube excavated. At the junction of this blind alley with the main thoroughfare an inner door of fine silk is woven. This curtain is so arranged that it can be made to fall back or come forward to suit the convenience of the little householder. By its use the spider is able to divide its domicile into entrance-hall, dining apartment, and withdrawing-room.

THE TURRET SPIDER



A FORKED BURROW



Should the occupant take refuge behind the curtain, and thrust it forwards, the appearance from above would be that of a short tube. If the main tube be invaded the wily gentleman can dart up the oblique gangway, closing the door behind him, so that he becomes again hidden from view. As the door suits the convexity of the tube, the eye beholds nothing but a long blind tunnel. Should the visitor be a victim to be welcomed, rather than a foe to avoid, the spider's chances of making a capture are greatly increased by the threefold arrangement of its retreat.

A Trap-door Spider of Southern Europe has been observed to leave its dwelling at night and spin a snare in the immediate vicinity. The insects which it is successful in catching are conveyed for consumption to its den. Then the remains of the web are packed up and cleared away, like a travelling circus, before daybreak.

The young find refuge and protection under the parental roof for the first few weeks of life. They then venture forth, to construct for themselves forked burrows in all respects similar to the home they have left, except in size. These tiny spiderlings, one-sixth of an inch in length, will construct a forked burrow three inches in depth and finish it off with a miniature trap-door. In the instinct and skill displayed in the work of these little creatures we have a glimpse into the actual fairyland of spider life.

The cellared dwellers of Spiderland have but two representatives among our British spiders. They are not Trap-door Spiders in the true sense. Above

their cellared dwelling extends a silken purse-like web, stretched for two inches over the adjoining vegetation, or secured against the stems of heather. The web appears to be an elongation of the silk lining of the burrow, which is excavated in light sandy soil, and well lined with strong webbing. This cellar is, apparently, the banqueting hall, as the remains of insects and occasionally of earthworms have been found therein.

Within the confines of her silken purse the spider, whose name is *Atypus*, awaits the approach of prey. Any unwary insect is speedily dragged within her lurking place, as the creature is furnished with formidable jaws by which she tears open her web and secures her prize. These weapons are of such an enormous size that the power of vision would be greatly hindered were it not that Nature has provided a turret for the eyes. From this watch-tower the spider has an unobstructed view in almost any direction.

Akin to this species is one found in America, known as the Purse-Web Spider. Its tube is spun against the trunks of trees for several inches above the surface of the ground, and its burrow extends for a similar distance underground. The purse-web is covered with particles of sand, scraps of bark, and wood mould, from the neighbourhood of the trees upon which the spider builds. The resemblance of the web to its surroundings is often very striking. There seems to be a purpose in this. The spider depends for her sustenance upon the insects that crawl upon her tube. As the tube is so disguised that it closely resembles its sur-



A BRITISH CAVE-DWELLER



THE QUESTION PUT: "WILL YOU WALK INTO MY PARLOUR?"



roundings, the opportunities of capture are greatly increased, and the unfortunate victim readily falls a prey to its deadly foe in ambush.

The different styles of architecture favoured by the various underground dwellers in Spiderland form an interesting study. A curious structure is that erected by the funnel-maker over her underground burrow. It is a silken erection three inches high, narrow at its base and broad at the top, like the mouth of a trumpet. This structure is, apparently, an elongation of the silk sheeting which lines the underground tunnel. It is threaded upon, and attached to, the vegetation around. "This aerial portion," says Dr. McCook, "is snow-white, and at once attracts the eye, even from a considerable distance; the nests, rising up amid sparse grass, which serves to support but not conceal them, present the appearance of scattered white fungi."

This projecting network is, probably, designed with a view to securing some amount of protection for the young in their home. Its further purpose is, doubtless, to entangle prey, for there is no effort made to hide the structure, and it is a well-recognised fact that insects habitually alight on raised objects. In the cavernous depths of this abode the watchful spider waits, ready to sally forth, with murderous intent, upon any luckless captive in her snare.

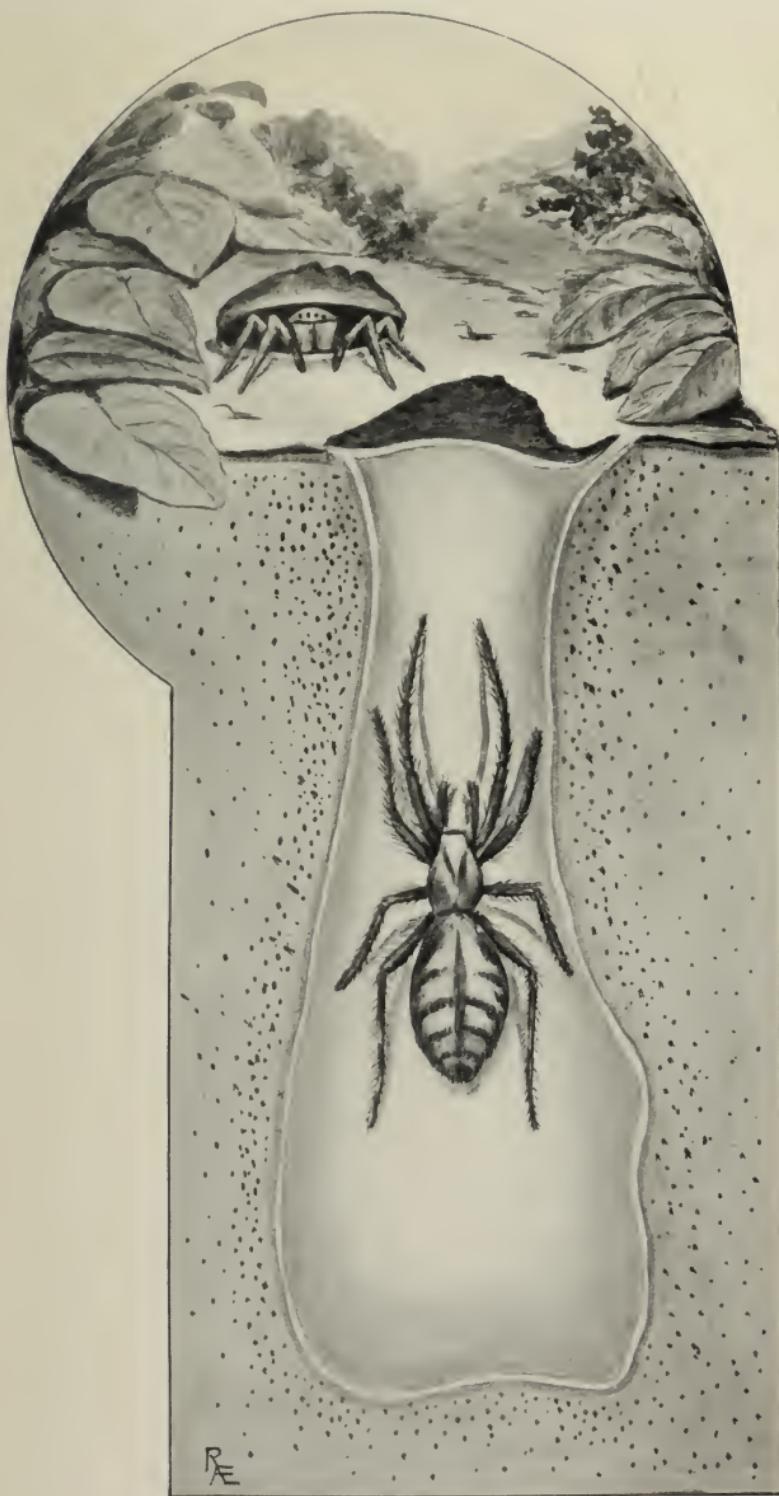
In the wheat and potato fields of Russia has been found an agile Trap-door Spider, which has received the name of "Opifex," meaning a worker. It is of special interest on account of the peculiar style of architecture which it favours. The silk-lined nest

is bottle-shaped, and furnished with a porch overlapping the rim of the burrow, like the lid of an old-fashioned country egg-basket. This porch has a wide, silken hinge and is composed of a single layer of silk, covered over unevenly with pellets of earth. The soil is placed much more thickly in front than behind, so as to weigh the door down into its proper position when not forcibly held open by the owner of the den.

The edge of the door, extending beyond the burrow, forms a portico, in the shadow of which the spider sits, sometime before sunset, watching for prey. The door is levered up by means of the head and forelegs, which rest on the margin of the burrow. At the slightest note of warning the spider dodges back into its den, and down flaps the door firmly and quickly, leaving no sign of its existence, so exactly does it resemble the earth around.

A trap-door somewhat similarly furnished with pellets of earth is to be seen in the Natural History Museum in London. The overlapping portion of the Russian species is absent, but the door of the burrow is weighted in the same way, so that it shuts automatically on being released. In addition to the soil used for the door is to be found a little moss, taken from the immediate neighbourhood, and placed between the nodules of earth at the top. The work of the spider thus approximates to the general appearance of the ground around and is a true work of art.

The Turret Spider (facing p. 74) builds a miniature, five-sided chimney over the mouth of her burrow. This chimney is formed of sticks, pine needles, and grasses,



A BOTTLE-SHAPED NEST WITH OVERLAPPING LID

together with pellets of earth removed in the process of excavation. These materials are lashed together by the spider's threads into a more or less circular form. After going down two inches the little mason begins to lay the foundation of the turret by placing bits of stick around her cave, and filling up the spaces between them with the earth she excavates.

The turret thus erected helps to conceal the owner's silk-lined retreat, while it serves, at the same time, as a convenient watch-tower from which to spy on friend or foe. Upon this elevation the spider may sometimes be seen, with her cocoon attached to her body by the spinnerets. On cool days she keeps her eggs in the depths of her tunnel; but when the warm sunshine invites her forth, she carries her casket, as large as a hazel nut, to the warmer regions above and there gives it a sun bath. For the mother Turret Spider is an anxious parent, carrying her cradle about with her for about two months, and never losing an opportunity of encouraging the young to hatch out.

When the baby spiderlings finally burst forth from their prison house, which they do all at the same time, they climb upon the back of their devoted parent till there is nothing to be seen but legs and tails of spiderlings; and she doubtless feels as bewildered with her large brood as the old woman who lived in a shoe. The mother's back is covered with soft down, to which the youngsters cling in lieu of apron strings. The affectionate attentions of a hundred fond infants would be an embarrassment had not Nature been very generous in her distribution of mother-love.

After the first moult, which takes place in about a fortnight, the mother's back may be seen to be decorated with the cast-off skins of her offspring. After a month the spiderlings will gradually leave the maternal care, ballooning away to pastures new, to set up cave dwelling according to the established custom of their ancestors. The burrows are miniature copies of the old home; and as the creature develops the burrow is gradually enlarged, arriving at its full dimensions when the spider comes of age.

One of these caves was once left plugged with cotton wool. After three days it was found that the little owner of the dwelling, finding the cotton wool nice and soft, had appropriated it for lining her abode.

The seaside residence of the Turret Spider is adorned with small pebbles, gathered from the surrounding sand. These form a foundation for the usual turret of twigs and grasses, and lend variety to the architecture of dwellers underground.

The ancestry of the Burrowing Spider is one to be proud of. It carries us far beyond the time of the pre-historic cave-dwellers of the human race, even before man walked this earth and fashioned his primitive weapons for the hunt. In that dim and distant past, when fearful and wonderful beasts roamed the earth, the humble spider took its place in the economy of life, and fulfilled its sphere as an inhabitant of this globe. Specimens of these early spiders have been preserved in coal measures, and others have been found embedded in the slate formations of Silesia. The latter include the oldest known fossil spider, belonging, in all probability, to



THE OLDEST FOSSIL SPIDER



the burrowers of Spiderland, from the appearance of its short, stout legs and palps. The oldest American spider is one of hoary antiquity, having been found in fossil form in the coal measures of Illinois. These relics of the past tell us that, in that time of long ago, when the sun was shining upon the trees and ferns of primeval forests, and the coal was being formed which we are burning in our grates to-day, the spider lived and moved and had its being.

Another fossil spider belonging to the burrowing family of those ancient times was found in the Isle of Wight, and has been placed by Dr. McCook side by side with the purse-web weavers, such as we find still actively engaged in their burrowing operations in our country. We may thus conclude that this spider, or its near kinsfolk, has been an inhabitant of these islands since the stone of the Eocene Tertiary epoch was in process of formation.

It is not difficult to see how spiders and insects came to be embedded in stone. A quiet, fresh-water lake, overshadowed by trees and water plants, among which spiders were domiciled, was overwhelmed by showers of volcanic ash. These showers carried with them the existing life of the day. The mud deposit dried and hardened into stone, preserving within it the forms of creature life with which the lake side was peopled. Such seems to have been the course of things at Florissant, in Colorado, where, in the bed of an ancient lake, many fossil forms of spiders and insects have been found.

The ancient seer, when he wished to speak of that which was most fleeting and transitory, said it was as the weaving of a spider's web. In spite

of its ephemeral character the work of spiders of antiquity has been brought to light, in the shape of little rounded cocoons which have lain buried for unnumbered ages. A discovery like this reveals the fact that the habits of spiders are such as "age cannot wither, nor custom stale."

A large number of spiders have been found embalmed in amber. As the liquid resin exuded from the ancient amber pine trees, like gum from a plum tree, spiders and insects became embedded in it. These trees were carried under the sea, many years ago, by the sinking of the land. The amber deposits, hardened with age, have been cast up on the shores of the Baltic, bringing with them the imprisoned spiders in a perfect state of preservation. We picture these ancient spiders of long ago, in the depths of the antediluvian forests of the Baltic, ensnaring, trapping and running down their insect prey, feasting upon flies, locusts, dragon flies, and beetles, and otherwise enjoying life, even as spiders do now.

CHAPTER IX

HUNTSMEN AND ACROBATS

AMONG the largest of the huntsmen of Spiderland are the wolf-like Bird Spiders of the Tropics. The name of "Bird Spider" has been given to certain hairy monsters because they have been supposed to gain their livelihood by preying upon the feathered tribe. That this is their habit of life has yet to be established. As one has seen these creatures at night, by the aid of a lantern, racing over the ground with great swiftness, the impression of a mouse seeking cover has been irresistibly suggested. This may probably be the reason the name "Mygale," signifying mouse, has been given to this gigantic brute. One may well speak of the "horrid" spider in this connection; for this creature, whose legs span seven inches, is of a decidedly uninviting aspect.

The Mygale is armed, for purposes of hunting, with sharp hollow fangs having an aperture near their points through which poison is emitted. The habit of this creature is to venture upon its hunting expeditions under cover of darkness, and pounce with tiger-like fierceness upon any luckless victim that comes in its way. By means of the deadly weapons with which it is furnished, it speedily renders the strongest insect helpless.

In the daytime the Mygale hides under stones, or lurks in dens and caves of its own making. During the rainy season in South India these creatures are often driven from their dens to seek shelter in the roofs of the houses, and their presence becomes a source of dread to the country people, who live in much fear of them.

These giants of Spiderland are powerful burrowers. Their formidable jaws and leg-like palps are used with great effect in the process of digging. By their means the loose earth is gathered up into a ball for excavation. Pellet by pellet, the earth is carried, clasped in the two foremost pairs of legs, to a dumping ground at a short distance from the mouth of the cave. By the exercise of that patience and perseverance for which its kind is famous, the spider excavates a burrow two inches in diameter, and running in a slanting direction to a depth of two feet.

The Mygale's burrow is one of the simplest to be found among the earth workers of Spiderland. It is lined with a rough outer silken coating to prevent the earth from falling in, and an inner lining of finer texture. The abode is not furnished with a door or covering of any kind, its cavernous depths evidently affording the occupant sufficient protection. On the threshold of her cave the expectant spider waits, ready to sally forth upon her unsuspecting prey, or flee to the deepest recesses of her burrow should danger threaten. This creature when in captivity, like other spiders under similar conditions, will take water with great relish, in addition to the juices of her prey.

THE MYGALE IS A HAIRY MONSTER



Under the influence of fear or surprise the Mygale assumes a formidable aspect, and emits at the same time a curious sound. The body is raised and the forelegs are held out in front of the creature in a most threatening manner. The jaws and palps are furnished in some species with rows of spines, which are made to work on each other as the defiant attitude is assumed. The musical apparatus is, therefore, a mouth-organ, and the sound produced is best represented by drawing the back of a knife over the teeth of a comb.

Among the huntsmen of Spiderland is the far-famed Tarantula, so named after the town of Tarentum in Italy, where it was at one time abundant. It is incorrect to apply the name to the large hairy monster of the Tropics which we have already noticed. The poison of the Tarantula is supposed to be of a very deadly character. A form of wild frenzy and dancing madness was said to result from the bite, but whether the dancing was the cause or the cure of the bite it is not easy to determine. The notion gained favour that music would assist the victim in attaining the proper degree of frenzy to effect a cure by inducing profuse perspiration. This gave rise to what is known as the Tarantella dance.

There is no doubt that the deadly character of the poison of the Tarantula has been much exaggerated. Its potency, however, is no myth, for Fabre, the French naturalist, discovered that the poison proved instantly fatal when bees and wasps were bitten. The spider had the instinct always to strike these insects in the weakest spot in their armour, namely, at the point where the head is

united to the thorax. By this method of attack the spider wisely avoided the possibility of being stung.

The hunters of Spiderland have their less formidable representatives in all our fields and woods, coursing over the grass and dried leaves in search of prey, or lurking among flower petals for insect visitors in quest of nectar or pollen. They are true vagrants, wandering over great distances on their hunting expeditions, and pouncing with wolf-like ferocity upon their prey. They are eminently fitted by Nature for this purpose, in length and strength of limb, keenness of vision, and stoutness of frame.

We have sometimes seen how the fore legs are held out straight when running, so as to serve the purpose of antennæ or feelers. This antennal use of legs may often be observed among spiders while snare-weaving, or when prospecting from point to point, reminding one of the way ants and wasps wave their feelers while engaged in their various occupations.

The possession of a cocoon of eggs seems to be no encumbrance whatever to the movements of these active little creatures. Wolf Spiders usually carry the cocoon firmly attached to the spinnerets and not by means of the mouth-parts. The hunting spider presents a curious appearance as it is seen darting about, laden in this manner with a tabloid-shaped cocoon almost as large as itself.

The mother Pirate Spider is like-minded in that she scorns any device for the protection of her offspring, but must needs carry her wealth about with



WOLF SPIDER CARRYING ITS COCOON

her. We have here a mother who is certainly much attached to her offspring. The cocoon is not only secured by several strong threads to the spinnerets, but also grasped by the palps of the spider. Should her silken sac be forcibly taken from her, the fond parent will hunt for hours for her golden treasure. If a ball of pith be quietly substituted she will joyfully pounce upon it and retain it, fully accepting the feeble deception.

The spider appears to trip about on tip-toe, for the size of the cocoon she carries compels her to extend her legs to the utmost. She manages, without apparently suffering any inconvenience to herself, to convey her cocoon wherever she goes. Thus burdened, she continues her excursions by land and water in search of prey.

There comes a time, however, when, by some strange intuition of Nature, she knows that the hour is at hand for the young to emerge from the eggs. The mother thereupon proceeds to spin a silken nursery for the reception of her babies on their appearance from the cocoon she has so long and faithfully carried. She remains the devoted guardian of her young until they have gained a good start in the world, and are well able to follow out their inherited piratical tendencies upon the bosom of the deep.

On land and water the Pirate is equally at home. True to its name, it skims the water with great swiftness in hot pursuit of insect prey. Should danger threaten it will hide under water, clinging to aquatic plants till the course is again clear and it is able to emerge with safety. Its downy covering

retains sufficient air for the maintenance of life during the space of time it remains submerged.

Some fearless mariners of Spiderland venture upon the deep on rafts. The Raftsman is a fine fellow, of interesting habits and remarkably handsome appearance. He courageously ventures upon the waters, buoyed up on a little boat of dried leaves and stalks bound together into a ball by silken cords. This bold navigator needs neither chart nor compass, but allows the current to carry him along or the wind to drive him leisurely whither it listeth. From the vantage-ground of his craft he watches for some drowning fly, moth, or gnat emerging from its watery prison-house. The venturesome spider speedily forsakes his raft, to pounce with ferocity upon his helpless prey. He then returns in triumph to his shallow ship to dine. Great is the harvest of the waters, and few insects escape these voracious and daring pirates.

The great strength of these water-loving huntsmen of Spiderland is illustrated by an incident recorded by Dr. McCook. The strange movements of a large spider in the middle of a small stream attracted the attention of two observers. On closer inspection it was found that the spider was struggling with a small fish, some three inches in length, which it had somehow managed to catch. As these two strange combatants struggled together they came near the bank, whereupon the spider clutched the sides with its feet and, after considerable effort, brought his catch to land, and actually hoisted it half its length out of the water. The fish which was so strangely caught weighed five times as much as

the spider, whose strength, thus demonstrated, was by no means inconsiderable.

The eyesight of hunting spiders is, doubtless, very keen, as they stalk their prey with great accuracy and stealth. Nature seems to have compensated them thus for the poverty of their spinning powers. The sense of sight appears to be most highly developed in the acrobats, or Leaping Spiders.

The Zebra Spider affords a ready example of keenness of vision. The little creature is to be seen on any sunny day in summer, frisking about on walls and along garden walks, on the *qui vive* for any game that there may be about. Having taken anchorage by means of its spinnerets, it leaps with dexterity and determination upon the unlucky fly that comes within its range of vision. The jerky movements of the head of this keen little sportsman, as it lifts itself on the tips of its front legs to look about, are evidence of its quick-sightedness.

The Zebra Spider takes its name from the black and white stripes with which it is adorned. These markings are formed by the accumulation of white scales in patches upon its body. They appear like tiny leaves overlapping each other, after the manner of tiles on a roof. There are also large numbers of feathery, iridescent scales, which shine with rainbow lustre in a strong light and are very similar to the scales which beautify the wings of butterflies. Many of the leaping spiders are of remarkably bright and beautiful colouring. They are spoken of by Wallace as "perfect gems of beauty," their bodies sparkling in the sun with lustrous hue and jewel-like radiance.

These little creatures are expert jumpers, their

stealthiness of movement suggesting the ways of the cat tribe in the pursuit of game. If a cat were endowed with leaping powers in the same proportion, it would jump the road from side to side at a bound. In approaching its quarry the Leaping Spider moves



Scales of the Zebra Spider (magnified)

with the slow and steady march of the shadow on a dial. Having come within measurable distance, it makes sure of its ground by fastening a silken cable to the object it happens to be standing upon, that it may recover its equilibrium should it fail in its quest or miss its footing in the scuffle. Then the spider leaps upon its prey with tiger-like spring,



THE LEAPING SPIDER CASTS ANCHOR BEFORE
SPRINGING UPON ITS PREY



FOOT OF LEAPING SPIDER, SHOWING
CLUB-LIKE HAIRS

and burying its fangs in its victim's body it speedily puts an end to its struggles. The feet of the leaping spider are furnished with club-like hairs, and to this special possession the creature owes its astonishing sure-footedness.

The elegant dress with which the acrobats of Spiderland are attired is supposed to have special reference to love, courtship, and marriage in their little world. The swain, in full dress of many hues, seeks to win his lady-love by displaying his charms before her to the best advantage. On approaching the presence of the lady her lord dances, waltzes and attitudinises in true peacock style, that the object of his affections may be duly impressed with his manifold and superior charms. Should his suit prove unsuccessful he may, if not wary, speedily find himself on the dinner-table of his ferocious charmer.

In the entertaining if uneven course of his true love, *Splendens* clearly seeks to impress the eye, if not the heart, of the female with the beauty of his iridescent body and showy palps. When we see some of the strange attitudes assumed by the acrobats of Spiderland, we ask: "Could anything in old-world courtship be more engaging than this?"



The Leaping Spider's love-dance

Rival males meet and greet in an innocent way. Though they assume very striking attitudes towards one another, waving their fore legs about in a very showy and pretentious manner, they mean nothing. They are for the most part kindly disposed towards each other and spar harmlessly. It is only when they open up negotiations with the opposite sex that the apple of discord is brought into the piece.

The lady on her part watches the tournament with much apparent interest—interest so marked that any tendency, for the time being, to slay and eat the wooers is abandoned. Finally she makes her choice, and the rejected suitors speedily decamp lest a worse thing come upon them.

Two suitors of the same species, one the normal red and the other a black variety, present themselves before the same lady. They dance and waltz and caper around to her evident interest. The special adornment of tufts of hair on the head of the black variety gives their owner the air of a veritable dandy of Spiderland. The little fellow in the plumes makes up in boldness and vivacity what he lacks in lustre, and invariably comes off victor, to the sorry discomfiture of the red. Here we trace a remarkably refined colour sense. It may be an instance in which the bride was worn out by persistence rather than wooed and won by love.

Of Morsitans, a savage monster of this order, an eye-witness records that two males came before a female. They had offered her the merest civilities, when she leaped upon them in turn and killed them. Such is life in Spiderland !



MALE LEAPING SPIDER



FEMALE LEAPING SPIDER

CHAPTER X

FOES AND DEFENCES

SPIDERS whose instinct it is to leap upon and ensnare insects, are themselves subject for the most part to great dangers, hence their enormous egg-laying capacity. In cases where the risks are lessened or reduced to a vanishing point by special conditions or endowments, the number of eggs is appreciably less, and sometimes very small indeed. Among the orb-weavers, which are clearly exposed to great risks, large numbers of eggs are deposited. The Diadem Spider's cocoon contains about six hundred eggs, while twice that number is laid by Argiope, her American cousin. On the other hand, the Diving Spider lays from forty to a hundred; while there are some spiders, as, for instance, those that enjoy protection by their likeness to ants, which deposit only three or four eggs in their cocoons. About this number of eggs is laid by the spiders domiciled in the perpetual gloom of caverns and dark places of the earth.

Little wonder need be entertained on opening an egg-casket to find a thousand eggs, when we bear in mind the terrible dangers that beset the path of the spider in his various walks of life. He rarely dies "in his bed." His end usually comes by battle,

murder or sudden death. When we see four or five hundred young spiderlings on a five-barred gate taking their first outing, it is pathetic to think that possibly only 10 per cent. will reach maturity.

Spiders are beset by foes, not only from without but from within. Parasites have been found infesting their bodies and also established in residence within, where they feast upon their very substance until nothing but a withered skin remains to record the tragedy.

Similar raids are made by that very common and very subtle foe, the ichneumon fly, upon the cocoons of spiders, and vast numbers of eggs and spiderlings fall prey to their persistent depredations.

These parasitic onslaughts open up an interesting study. Spiders' egg-caskets have been found containing little cocoons of flies which have also been infested by still smaller flies. Dr. McCook tells us that he received a cocoon of the Basket Argiope, wherein was found a large number of live spiderlings. There was also a mass of parasitic cells of an ichneumon fly, which, in the grub state, had doubtless eaten many of the spider's eggs. Within some of these cocoon cases were found other guests of a smaller type in the grub state. This was not all, for on careful observation there were discovered several specimens of a minute winged insect, a parasite of parasites, reminding one that :

“ Great fleas have little fleas upon their backs to bite ‘em,
And little fleas have lesser fleas, and so *ad infinitum.*”

Argiope's cocoon had become in this way a guest chamber, entertaining a numerous and varied com-

pany of one mind and purpose, namely, to feast at the expense of their generous host. From the ranks of the insects which form its chief prey, the spider's most deadly foes arise. It is thus that Nature holds the balance true.

The mud-daubing wasp is a familiar creature to anyone who has lived in the Tropics. It will often be seen invading the house, carrying between its feet and mandibles a pellet of mud. This is deposited in some crevice, and the process is oft repeated till a rounded nest about an inch long is constructed, wherein the wasp is prepared to place an egg.

But first, by a compelling instinct, she seeks a supply of food for the waspling upon its egress from the egg. This waspling is nothing but a white maggot, and its food consists not of nectar but of the flesh of spiders and caterpillars.

The wasp boldly attacks the orb-weaver as she patiently sits in the centre of her snare ready in her turn to pounce upon the unwary fly. "Upon how frail a thread does the spider's life depend!" As many as seventeen spiders have been found in a single nest of the mud-daubing wasp, and she will make perhaps forty nests.

I have many a time seen these wasps heavily laden with such food, carrying it, humming the while, between the mouth parts and feet to their mud nests in the angles of furniture or corners of the walls. On one occasion a wasp of this description sought to make my slipper a refuge; and in the morning when I innocently put my foot into it, I withdrew it with precipitation, to find the wasp clinging to my big toe,

and punishing it severely with its formidable sting for rudely invading its sanctum.

The sting is ordinarily used with great effect upon the luckless spider, which the mother wasp hunts with diligence and determination. Spiders are not killed outright as a rule, but stung in the nerve centres, so that in a state of death in life the wretched creatures are doomed to await the emergence of their devourer from the egg within the mud walls of their prison-house.

By a remarkable display of instinct the wasp is able exactly to meet the requirements of her children, when they emerge from the egg as voracious young larvæ, by paralysing her victims without rendering life extinct. In a state of death the spider would shrivel and fail to serve as food for the hungry wasplings. The mother knows, by a strange intuition of Nature, that they will require such food and require it fresh.

Some of the spider-hunting wasps first catch their victims and then proceed to make their nests, in the meantime impaling their prey in a convenient crotch of the branching stems of sorrel or bean, out of the reach of ants, till all is ready for their entombment. The mother wasp then carries them to their burial, holding them by the thorax with her jaws, and seals them up with her egg in the mud nest she has prepared.

One of the largest and most beautiful of the solitary wasps is *Pepsis*, popularly called the "Tarantula killer," because it specially covets this great spider for its nest. When the wasp discovers such a prize, it circles around it, while the spider makes



A SPIDER'S FIGHT FOR LIFE

a fair show of fight by assuming a formidable attitude. In the fight for life that ensues he soon realises that his chance is hopeless. He vainly endeavours to escape as his great enemy draws nearer and nearer in ever narrowing circles. Dropping his terrifying attitude the spider seeks refuge in flight, to be speedily overcome by his assailant, who drives home her deadly weapon with paralysing effect. When the fatal blow has been struck the wasp deposits her victim in her earthen nest, carefully beating down the soil upon it and covering it with small stones as if to hoodwink the inquisitive. This procedure is gone through time after time till the mother wasp has deposited all her eggs with the same studied provision for wasplings.

Besides parasitic flies and marauding wasps, spiders have many other foes. Monkeys, ants, snakes, lizards and toads raid upon spider colonies with deadly effect. Small birds are great enemies of the spider, and delight to find such tender morsels upon which to prey. Even before leaving the cocoon spiders are subject to depredations from bird foes, sun-birds and others weaving their spinning work into their nests. Some tiny sun-birds built their beautiful little swinging nests in my garden in India mainly of soft spiders' silk, braced up with bamboo fibres and decorated with withered leaves.

Nature has endowed her children in many ways by which to secure their preservation. She does not readily let a single species die out. Some are endowed with great egg-laying powers, while others are preserved from destruction by special features that, in either an active or passive way, enable them to hold

their own in the grim struggle for existence. The battle of life would go hard with some if it were not that they are endowed with special virtues, which we are accustomed to call mimicry.

Some spiders are adept at feigning death, others shake themselves with such vigour as they cling to their snares that, by their rapidity of movement, they become "lost to sight, to memory dear."

Many spiders enjoy protection by their adaptation to the likeness of objects about them. In tropical countries, where insects assume the semblance of leaves, twigs, flowers, bird droppings, knots of wood, and other objects among which they dwell, we are not surprised to find spiders masquerading under quaint disguises and curious shapes.

Some mask their presence by conforming to the colours of their surroundings. This "mimicry of environment," as it is called, forms a most interesting subject for Nature study.

The creatures that seek protection by mimicry must be seen in their habitat if we are to realise the perfect disguise with which Nature often endows them. For instance, a python is a striking object in captivity, but in its native haunts it is almost invisible. I once walked within a yard of a huge python before my steps were arrested by its beady eyes. Its body was wellnigh indistinguishable from the surrounding leaves and grasses of the jungle. We often notice the same feature of cryptic or hidden resemblance in the study of spider life.

Mimicry in the spider world is largely aggressive ; that is to say, in colour, form and movement, spiders have special gifts to enable them to come within



MIMICRY IN SPIDERLAND

1. *Epeira Strix.*

2. *Tetragnatha Extensa.*

3. *Misumena Vatia*

4. *Orchard Spider.*

striking distance of their quarry. We can readily understand how white or cream would be a fatal colour on bark or green leaves. A little cream-coloured crab spider, by frequenting the white blossoms of hedge parsley, is thus well protected from its enemies. Its chances of prey are at the same time greatly increased, as it keeps a good look out for the small insects which visit the flower heads for pollen and nectar.

A crab spider, *Misumena vatia* by name, is a pretty fellow in his yellow robe, splashed with reddish or pink spots. The habit of this creature is to frequent flowers of a colour similar to that with which he is adorned. He lurks among the flower-petals, where his presence is completely masked by Nature's protective garb. He is able, thus disguised, to seize any flower-loving insect with ease. Travellers in the Tropics have repeatedly noted the astonishing likeness of these spiders to flowers, the ray florets being represented by the extended legs of the creature as it sits awaiting its prey. The luckless butterfly as it alights to sip the nectar of the flower, readily becomes a prey to this heartless hypocrite of the spider world, lying in wait for innocent blood. Bates, a keen observer of Nature, speaking of South American species, says : " Some hunting spiders mimic flower-buds, and station themselves motionless in the axils of leaves and other parts of plants to wait for their victims."

We may see, almost any day in summer, a small brown crab spider lurking among the florets of the common ragwort, or emerging to secure a visitor to the flowers, such as a bluebottle fly. Seizing one

five times his own bulk with savage ferocity, and holding it with remarkable tenacity, the bold little fellow threads his way with his heavy burden, through a labyrinth of tall grasses, in quest of a retreat wherein to enjoy his bulky prize in peace.

The colours by which spiders enjoy protection often harmonise with the sand of the seashore, or the lichen and bark of trees, where they habitually hunt for prey.

The long-legged, long-bodied spider, of greenish colour, which is often found in our gardens, much resembles the stalks of grass and twigs among which the snare is set. The attitude he naturally assumes also helps to hide him from view, for he habitually stretches his legs fore and aft, in a line with the grass stem or branch, thus most effectively masking his presence. Orb-weavers are often so much like the foliage and knots of the trees among which they live, that they find easy concealment in a recumbent position, with legs bunched up around their rotund bodies. Colour protection has two ends. It helps a spider to eat and guards him from being eaten ; for it is ever a case of eating or being eaten with him.

Some of the forms of mimicry that have been observed are very curious. Drummond tells us of an insect, exactly resembling a bird-dropping, which he observed in tropical Africa. A naturalist while hunting for insects in Java observed a similar form of mimicry in the spider world. Noticing a butterfly settle, he went to it, and in the act of lifting the insect found its wings had come away in his fingers, leaving the body upon a whitish mass. This, on closer



CRAB SPIDER LURKING AMONG FLOWER PETALS

observation, proved to be a spider masquerading under this remarkable disguise. A spider adopting such an extraordinary means of deception may well be branded with the name of "Decipiens," for he is a great cheat.

I have noticed a somewhat similar form of protection enjoyed by a spider on the hills of South India. The dark centre of the creature's body, surrounded with white and grey markings, formed an excellent example of colour protection in a country where spider foes abound. Even in Spiderland we find that "things are not what they seem."

The Trap-door Spiders adopt most ingenious methods for the concealment of their homes by attaching leaves, moss or lichen to the fibres which comprise their front doors. So perfectly does their work harmonise with the mossy or leaf-strewn ground around, that the most careful observer would be deceived did he not actually see the doors open and the skilful little tenant emerge.

Tunnels of Trap-door Spiders have been found in the South of France traversing ants' nests, and so neatly concealed were the doors with which they were protected, that they were only discovered by working upwards through the tunnels to the surface. The ants upon which the spider preys would doubtless seek other pastures if the spider's nest were too obvious, for in vain is the net spread in the sight of any ant.

There are some inhabitants of Spiderland that bear a surprising resemblance to ants. These insects are imitated not only in regard to form and colour, but also in their fitful hurried movements. The

spider has assumed the appearance, manners and general bearing of the ant, having considered her ways and grown wise.

Although some birds, such as woodpeckers and game birds, readily eat ants, the ant-like form protects the spider from other birds, which devour the soft-bodied spider but refuse the hard-bodied ant. The greatest source of danger, however, is not from the feathered tribe, but raiding wasps. The ant-like form may very well protect this spider, whose egg-laying capacity is small, from such foes. The spider may further be helped in securing insect prey, as it lives by hunting.

Stellata looks remarkably like the rough seeds of certain plants as she sits with drawn up legs at the hub of her snare. Her colour, a dull grey or brown, assists her in concealing herself, especially when associated with the browned or richly tinted foliage of autumn. The slightest disturbance will send her suddenly to the ground, a common trick among spiders, where she assumes a death-like attitude. Spiders lying motionless upon a leaf, or upon the uneven soil, may easily be passed by without notice. It is, in fact, often difficult to detect their presence, even when they are carefully searched for.

Acrosoma is a curiosity of Spiderland, looking as if it could sit still for a century, simulating a knot of wood. It is, however, roused to strenuous activity after nightfall and builds an elaborate and beautiful web. This is strung up at a considerable height, as if purposely to ensnare one's face while traversing the woods. When one's nose penetrates a spider's

SOME ANGULAR CHARACTERS IN SPIDERLAND

AN ANT-LIKE SPIDER



snare one must not be hard on the poor wretch whose careful work is thus shattered at a stroke. The little architect knows that pathways are used by little winged folk, but the big folk do not enter into her calculation. It is a case of "each for himself" again.

The spiny armour with which some tropical spiders are equipped forms a most effective means of protection from their natural enemies. These are the angular characters of Spiderland, which present a very forbidding aspect to any bird on the lookout for a choice morsel.

An orb-weaver of South America has spines an inch and a half long, extending backwards with a slight upward curve. Why the creature should be thus furnished it is difficult to say. It presents a knotty point in the evolution of the spider. Here at least the bird of wisdom draws the line.

A spider of Madagascar has a curious crab-like form and a hard shell-like covering, and resembles in colour and appearance the fruit commonly to be found in the forests which the spider frequents.

The cocoons as well as the creatures themselves sometimes have a woody, horny appearance. In South Africa a horny mother spider of dark brown colour, decorated with tubercles of yellow, has been found weaving her web among thorny bushes. She fashions a number of warty cocoons, which are suspended in the centre of the upper half of her snare. As the spider hangs attached to the last cocoon in the string she becomes wellnigh indistinguishable from the thorny vegetation among which she slings her cradles.

Spiked and horny seeds of plants, shoots and knots of wood, buds of flowers, florets and oleander petals are among the objects that appear to be mimicked by the spider tribe. When the blood-thirsty spider takes the form of a hairy monster, looking as evil as his business, we feel that it is according to the fitness of things. But when the base creature assumes the garb of beauty in order to deceive, and utters a lie with every movement, we marvel at the perfidiousness of Nature, for even a spider "may smile and smile and be a villain."

CHAPTER XI

THE SPIDER A PHILANTHROPIST

OUR peep into Spiderland has, doubtless, taught us much. For ingenuity in construction, variety of workmanship and general artistic effect, the structures of its interesting little folk bear the palm in the animal world. In the spinning-work that has excited our wonder and admiration we see delicacy interwoven with strength, and symmetry with beauty. Truly wonderful is the display of adaptability, skill, patience and perseverance by the spider race, combined, as Huber observed of the bees, with "a little dose of judgment."

We cannot but deplore the cannibalism that so often sullies the stream of domestic bliss, and brings the course of true love to a sad and untimely issue. On the other hand, the maternal solicitude which is universally observed in Spiderland is most delightful to witness.

We have seen how in some cases the spider anticipates and in others aids modern science and human skill. Our microscopes and telescopes are made more efficient by the aid of her fine filaments in delicate measurements. The members of this most active and intelligent community are in many respects highly serviceable to mankind. If we put in a

plea for the spider it is because she has proved our friend by slaying our enemies. Our attitude is justly one of gratitude towards her for destroying the early fly. These nimble-winged visitors so rapidly increase under favourable circumstances that they become not only a source of annoyance, but a real menace to health. Flies are the enemies of man. They are the carriers of cholera, diphtheria and other diseases, the germs of which are attached to their sticky little footpads. These noxious insects deposit their eggs on decomposing refuse, then wing their way into our houses, and perhaps breakfast in the sugar bowl, or take a morning bath in the milk.

So far, then, from despising the spider for following Nature's instinct in keeping down the abundant insect life about us, we may regard her in the light of philanthropist and friend. Truly, in seeking her own ends she furthers our interests. Among the feathered tribe we find birds of prey as well as birds of beauty and of song. Both the rapacity of the vulture and the beauty of the humming-bird are represented in Spiderland.

The spider is engaged with untiring energy throughout the summer in the slaughter of insect life. But for this service life would surrender much of its joy and earth would yield less of its fruits. A single web has been found to ensnare three dozen mosquitoes in a few hours, and we have seen twice that number of gnats and other small flies in an orb-web. Every gardener and fruit-grower well knows what a great pest the greenfly may become. We have seen webs entirely covered with innumerable quantities of these destructive insects. When



FOOT OF FLY, SHOWING STICKY FOOT PAD



A NICE JUICY MOTH FORMS A CHOICE DINNER FOR A HUNGRY SPIDER

we have seen the cabbage butterfly fall a victim to the spider's toils we have felt little regret; we have thought of the havoc wrought in the garden by these insects in the caterpillar state. Moths are often responsible for the destruction of fruit and forest trees, their grubs penetrating the very centre of the living tree. A nice fat juicy moth forms an excellent dinner for a hungry spider.

The weevil is an enemy to the pea and bean crops and apple orchard. To every farmer the spider proves her friendship by ensnaring numbers of these devastating beetles. The crane fly is another foe to the farmer, its grubs attacking grain and grass roots with most injurious effect. The mortal remains of this gaunt creature may frequently be seen decorating the spider's spinning work. Who can estimate the myriads of flies, butterflies, beetles, midges, moths and mosquitoes destroyed by the friendly spider in a single hot weather season? This insect host, if not kept well in check, would rapidly become destructive to vegetation, a pest in the orchard, a nuisance to man, and a fruitful source of danger to the health of the community.

It is not possible to fathom all the strange ways of Nature's bairns, but we see much that is interesting and instructive, much to excite our admiration and gratitude even within the limited scope of our brief study. As we look upon the spider world from the standpoint of human intellect, we marvel to see, evolving before us, all the mystery of life in its manifold bearings. In our endeavour to unravel a few of the threads of the spider's most interesting life, we have failed to find any trace of morals. But, as

Henry Drummond has said : " We have truth in Nature as it came from God ; and it has to be read with the same unbiased mind, the same open eye, the same faith and the same reverence as all other revelation."

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APR 02 1998

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